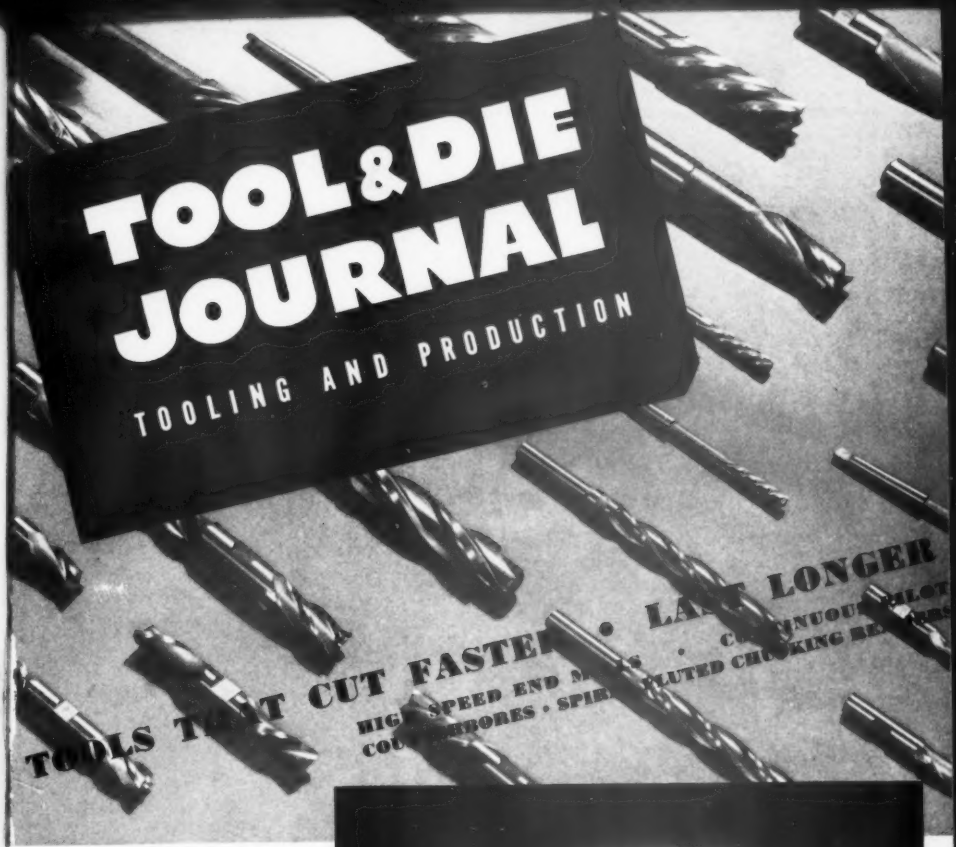

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PUTNAM END MILLS

Whether of 1/16" diameter or sizes up to the largest end mills made, all Putnam Hi-Speed End Mills permit maximum speed and feed. In addition, manufacturing and heat treating methods assure unusually long, trouble-free service. It is by actual use on your toughest milling jobs that you can prove to your own satisfaction that the end mills which do "cut faster and last longer" are produced by Putnam.

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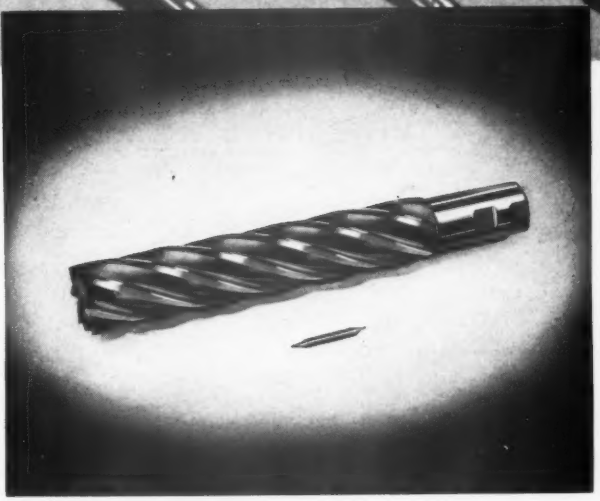

ARMY NAVY AWARDED AUG. 15, 1942

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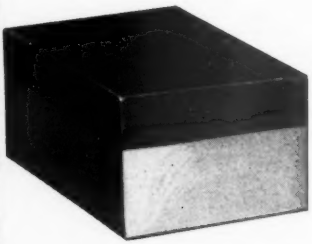

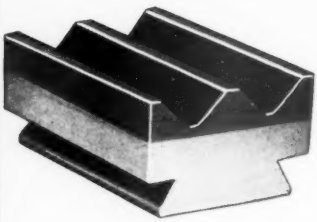

Special Bulletin contains full particulars and prices. Write for your copy of Bulletin TP today.

Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks *(high speed steel cutting face; mild steel base)* save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—

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5. *Marked saving of strategically important tungsten.*

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1" collet capacity, 9" swing, 17" center distance, eight spindle speeds up to 4000 R.P.M.

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THE TOOL & DIE JOURNAL

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Contents

Vol. IX, No. 4 July, 1943

Editorial · George J. Huebner	85
Use of Meehanite for Dies and Molds G. Hobman	86
Modern Drill Jig Design · C. W. Hinman	90
Precision Measurement	93
Human Engineering · Rear Admiral C. H. Woodward, USN and Bob Hamilton	96
Training for Victory	99
Fundamentals in the Use of Dies for Press Brakes	115
Absenteeism—A Sympton, Not a Disease	119
Short Run Dies · D. A. Rogers	120
Visual Gage Inspection · C. M. Bradford	121
Future for the Machine Tool Industry	122
Industrial Digest	133
Industrial Plastics	139
Publication Previews	146
Shop Aids	179
Progress on Parade	212
Advertisers Index	239
News Chips	242

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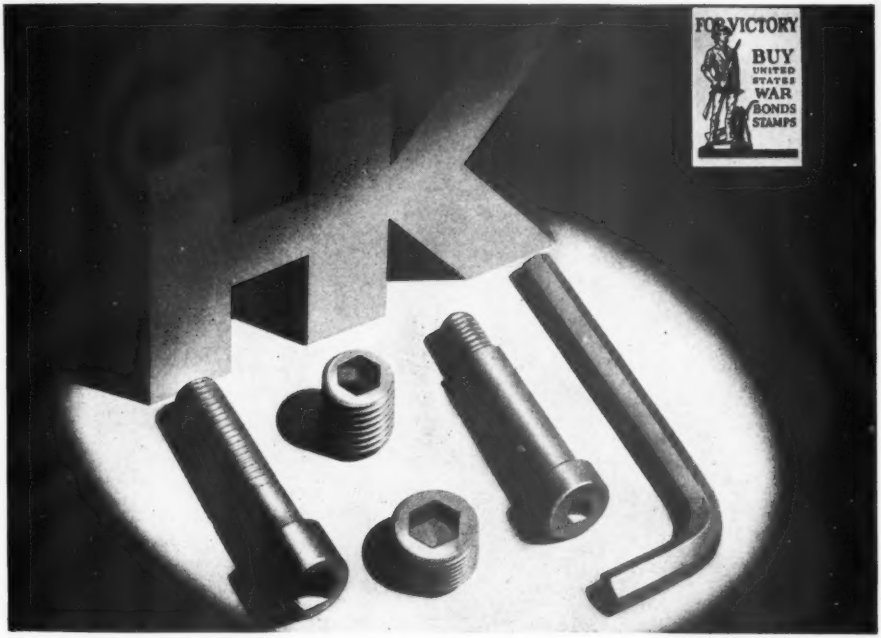
THE BETTER FASTENING METHOD



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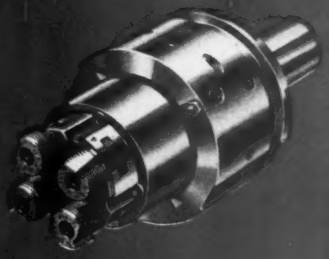

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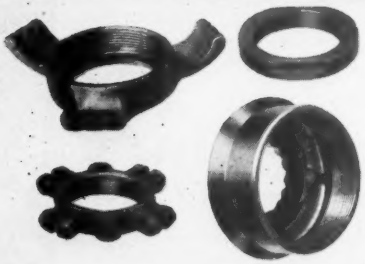
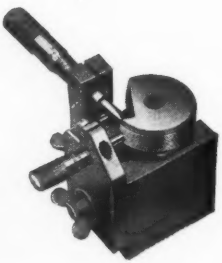


For extreme accuracy, on 3″ to 5″ work, ask us about RSP. Catalog D-42 will give you full details and specifications.



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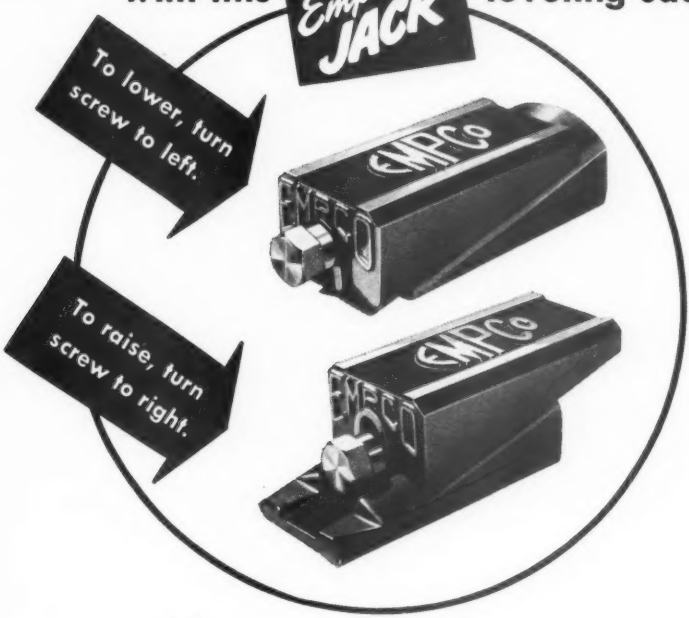

NOTE the design of Empco's mated castings which permit the lower part to align itself to an *uneven* floor while the upper part remains perfectly level. Note also, finished top of upper casting affording smooth slip-ways to various types of bases. This is the reason Empco Jacks can be quickly and positively adjusted so that you save time on installation of equipment and periodical leveling adjustments. This type of jack frequently eliminates cement foundation and floor bolts.

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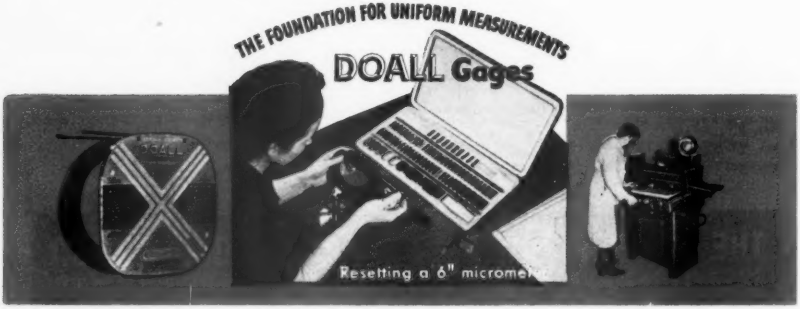

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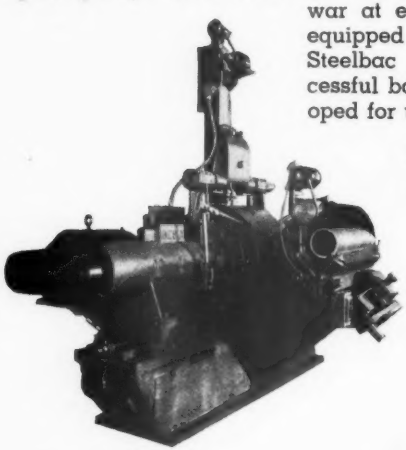

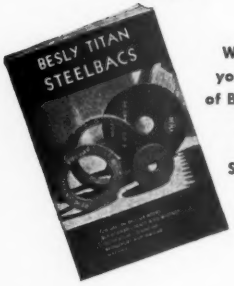

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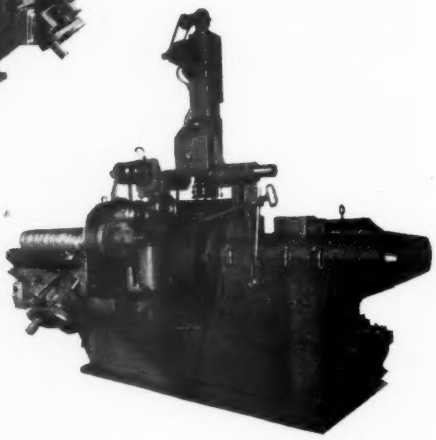

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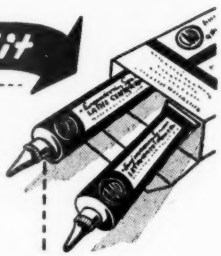

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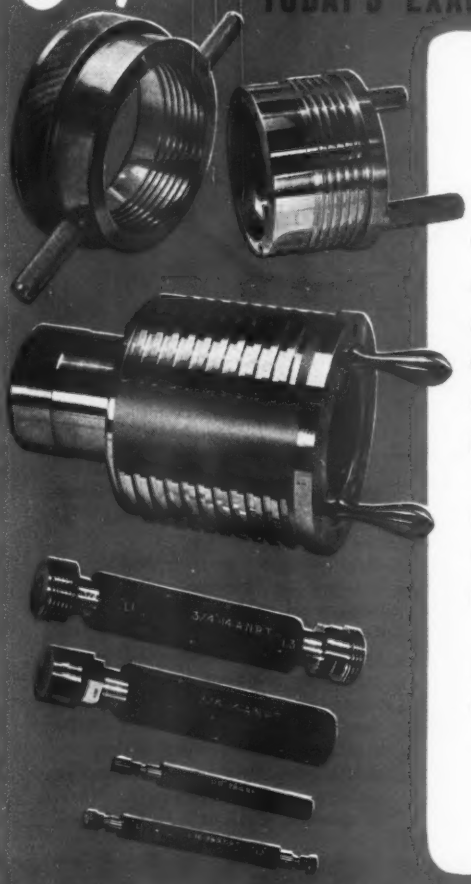

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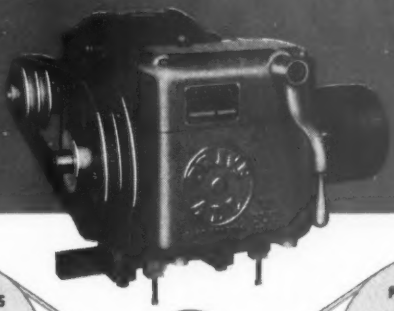

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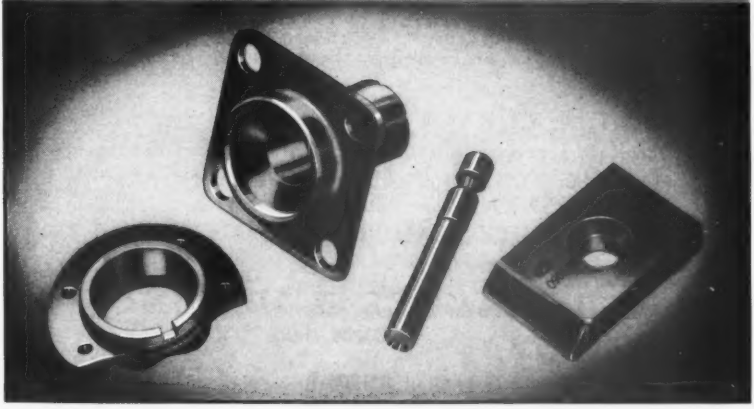

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even spilled milk is good for something!

Your tool and die failures need not be a total loss. Now that you know what you don't need, let us suggest a solution for many of these problems.

If you have made the mistake of using a tool steel that is tough to machine, investigate Graphitic Steels. Their easy machinability resembles that of cast iron. If your dies and tools are subject to terrific abrasion and are wearing out faster than you think they should, ask about Graphitic Steels' wearing qualities. If you are having trouble with distortion in the thin sections of your dies, these same steels will solve your problems.

Ask for your copy of the new Graphitic Booklet which gives complete technical and performance data. The Timken Roller Bearing Company Canton, Ohio. Steel and Tube Division.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

1887 *1943*

★ ★ ★ ★ ★ ★ LeBLOND CINCINNATI, OHIO U.S.A. ★ ★ ★ ★ ★ ★

What You See Depends Mainly on What You Look For

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12 to 50" Heavy Duty

TOOL ROOM
12 to 18" Precision Lathes

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13 to 24" Light Type Engine Lathes
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No. 2 Plain and Universal

"If It Turns — Consult Us"

THE R. K. LeBLOND MACHINE TOOL COMPANY

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CHICAGO: 20 N. Wacker Drive
Phone State 5561

NEW YORK: 103 Lafayette Street
Phone Canal 6-5281

EVERY TOOL STEEL HAS AN ALTERNATE

..it pays to know them

AS war production rises rapidly toward its peak, the problem of *materials* becomes more and more insistent.

High Speed Steels furnish one of the best examples, because these special steels depend for their properties on some of the most critical alloying elements in the list. Continuity of supply of High Speed Steel is absolutely essential to continuity of production; yet, under the exigencies of equable distribution, you may encounter a temporary shortness of supply in your first-choice cutting steels at any given time.

It would be wise to protect yourself against such an eventuality. Take precautions against a loss of production time and volume by learning the *alternate* tool steels for your jobs. Get familiar with them —just what they'll do and how they're handled. Frequently the alternate can step into the job with no loss of performance; in a great many cases, a steel can be found that will out-perform the original.

● *Play safe*—know the alternate tool steels for the types you customarily use—let our engineers help you.

ADDRESS DEPT. TD-4

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8845 ..W & D

GRINDING WHEELS DRESSED

quickly, accurately with UNIVERSAL Radius Dresser

YOU can do a better job by grinding the radii of your tools, dies and gages with grinding wheels dressed to gage-block accuracy. The American Radius Dresser is a sturdy, compact, precision-built unit that is easily, quickly set. It will clear a 7½ inch grinding wheel and dress convex or concave radii up to 1 inch.

Note the ease of setting up the radius dresser by use of gage blocks. Z-shaped set-up block is clamped to swivel arm and removed after diamond has been set for correct radius.

Swivel arm pivots on hardened and ground steel shaft with large thrust surfaces at ends.

Base of radius dresser is machined parallel to center line of swivel arm to set against straight edge of magnetic chuck. Not necessary to remove wheel guard. Swivel arm operated by hand wheel in safe, convenient position.

Dust-proof bearings; constant lubrication. Send for Bulletin 43-TDJ, including details on the precision-built, time-saving American Amplifying Gages, Hole Checkers, Thread Checkers, Bench Centers and Lapping Plates.

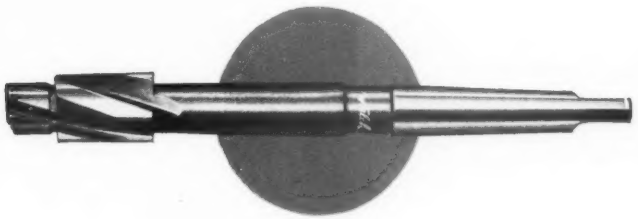
THE AMERICAN GAUGE CO.
125 Bayard Street DAYTON, OHIO

NOW *Welch* OFFERS

STANDARD
HIGH SPEED

COUNTERBORES

● IMMEDIATE DELIVERY ●



THREE PILOT SIZES CARRIED IN STOCK. UNLESS SPECIFIED NO. 1 WILL BE SHIPPED.

STRAIGHT SHANK

Order by This Number	Screw Size	Pilot Diameter 1	2	3	Cutter Diameter	Shank Diameter	Length Overall	Net Price Each
1-4-SS	1/4	1/4	17/64	9/32	11/16	1/2	3 1/2	$2.55
1-4-LS	1/4	1/4	17/64	9/32	23/32	3/8	5 1/2	3.00
5-16-SS	5/16	5/16	21/64	11/32	11/16	1/2	3 1/2	2.70
5-16-LS	5/16	5/16	21/64	11/32	23/32	3/8	6	3.15
3-8-SS	3/8	3/8	25/64	13/32	11/16	3/8	4	2.90
3-8-LS	3/8	3/8	25/64	13/32	23/32	3/8	6 1/2	3.25
7-16-SS	7/16	7/16	29/64	15/32	11/16	1/2	4 1/2	3.15
7-16-LS	7/16	7/16	29/64	15/32	23/32	1/2	6 1/2	3.65
1-2-SS	1/2	1/2	33/64	17/32	23/32	3/8	5	3.45
1-2-LS	1/2	1/2	33/64	17/32	23/32	1/2	7	4.10

TAPER SHANK

Order by This Number	Screw Size	Pilot Diameter 1	2	3	Cutter Diameter	Shank Diameter	Length Overall	Net Price Each
1- 4-1T	1/4	1/4	17/64	9/32	11/16	#1 Morse	5 1/4	$3.10
5-16-1T	5/16	5/16	21/64	11/32	11/16	#1 Morse	6	3.25
3- 8-1T	3/8	3/8	25/64	13/32	11/16	#1 Morse	6 1/4	3.35
7-16-1T	7/16	7/16	29/64	15/32	11/16	#1 Morse	6 1/4	3.75
1- 2-2T	1/2	1/2	33/64	17/32	23/32	#2 Morse	7	4.25
9-16-2T	9/16	9/16	37/64	19/32	27/32	#2 Morse	7 1/4	4.85
5- 8-2T	5/8	5/8	41/64	21/32	29/32	#2 Morse	7 1/2	5.60
3- 4-2T	3/4	3/4	49/64	25/32	1 1/32	#2 Morse	7 1/2	6.90
7- 8-3T	7/8	7/8	57/64	29/32	1 5/32	#3 Morse	7 1/2	8.50
1-3T	1	1	1 1/64	1 1/32	1 11/32	#3 Morse	9 1/4	10.35

— ● —

Welch INDUSTRIES, INC. 20000 W. 8 MILE RD. DETROIT, MICH.

MANUFACTURERS OF HIGH SPEED MILLING CUTTERS · FORM TOOLS · SPECIAL TOOLS

Here's a Grinding Wheel that Can Increase Production on *Many* Jobs

. . . The NORTON OPEN STRUCTURE *Grinding Wheel*

THE outstanding feature of Norton Open Structure Grinding Wheels and Segments is of course the large pore spaces that result in a very fast, cool cutting action. This means that No. 12 (open) structure products are especially suitable for jobs that require extra heavy stock removal, or extra coolness of cut or both—such as:

Surface grinding
Hob grinding
Formed tool grinding
Gear grinding
Internal grinding

This Norton open structure wheel is a real production booster on many jobs. But it is just one of several Norton structures available. Let Norton engineers study your grinding jobs and make sure that you are using the most suitable wheels in abrasive and bond, in grain and grade as well as in structure.

NORTON COMPANY
WORCESTER, MASS.

NORTON ABRASIVES

W-912

EXTEND TOOL LIFE...
and Conserve Essential Metals!

Salvage and Reclaim...

worn out tools or under-size parts... dies, molds and gauges... by applying ADVANCE Hard Chrome Plating.

Reduces wear on equipment and tools, and saves precious manpower.

Increases tool life and conserves steel.

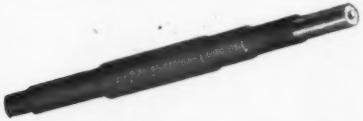
Maintains accuracy of gauging tools.

Reduces corrosion and scoring.

The Advance Plating Company is completely equipped to produce hard chrome plating on either a large or small production basis. Speedy production plus an accurate workmanship backed up by years of plating experience. Our engineers will be glad to study your shop problems and suggest plating operations that will cut tool costs, increase production, keep "rejects" at a minimum, and conserve equipment.

Write, wire or 'phone for Advance service

SAVED!
2000 UNDERCUT AIRPLANE GENERATOR SHAFTS!



The above illustration shows one of 2000 airplane generator shafts which were undercut on one end to a diameter that would not permit proper assembly into the generator. Hard chrome plating 0.003" thick was applied to the undercut portion and the shaft then re-ground to exact specifications.

Thus, in this instance, the application of hard chrome plating made it unnecessary to replace the undercut shafts with new ones, enabling the company to salvage these parts which otherwise would have been scrapped. At the same time it made possible a considerable saving in essential steel and additional production time.

HARD CHROME DIVISION
THE ADVANCE PLATING COMPANY
395 E. 131st Street • CLEVELAND 8, OHIO • Tel. GLenville 6742

APCO

GAGE GRINDING *Proves* ITS PRECISION!

Perfectly Balanced — Every rotating part of both motor and quill is balanced statically and dynamically to eliminate the slightest possibility of vibration.

Matched Parts — Mating parts are specially selected to keep dimensional clearances practically at zero.

Exclusive Quill Design — Patented pre-load spring and patented "Fog-of-Oil" lubrication, assure high initial and sustained precision under long hours of operation.

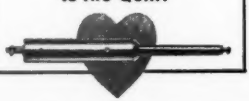
Gages being their sole product, the Shoberg Tool Company depend upon high precision equipment to supply their customers with gages of a wide variety, for vital war production uses. Grinding to closest possible limits is almost a continuous process in this shop, and the Dumore Precision Grinder functions as a real production machine, busy every working hour. Consistent performance under these conditions is possible only because of the high precision and lasting durability engineered and built into every detail of the Dumore Grinder!

Does high precision in large volume constitute a problem with you? Your Dumore distributor can show you how other shops are applying the "Dumore System." Or write us for a copy of our Catalog 42.

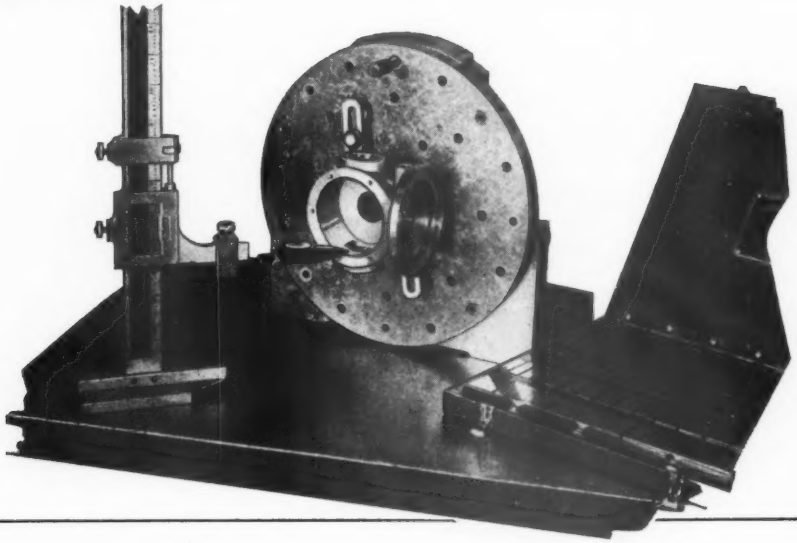
The Dumore Company, Grinder Division, Racine, Wisconsin.

Dumore PRECISION GRINDERS

The Heart of the Grinder is the Quill!



DUMORE PRECISION GRINDERS ARE SOLD BY AUTHORIZED DISTRIBUTORS IN ALL PRINCIPAL CITIES



A PRECISION UNIT FOR PRECISION WORK

Whatever the part — aircraft, navy or ordnance — you can be sure that the BECKER INDEX MASTER accurately and speedily determines its conformance with drawing specifications. No wonder many of the largest production aircraft plants have reordered it time and again — its dependable and accurate performance is needed on the production battlefront.

Comparing the present methods used in the inspection and layout of tools and parts where a bevel protractor sine bar must be set for each dimension, you can readily see the great advantage of using the BECKER INDEX MASTER—which saves valuable time.

Designers and Builders of Tools, Dies, Special Machines and Parts

From our Designing and Engineering Department to our final inspection, our facilities in equipment and manpower have been built to render exacting precision service. Send for circular illustrating our facilities.

The new descriptive circular on the BECKER INDEX MASTER is now available. Send for your copy today!

THE BUNELL MACHINE & TOOL COMPANY

1601 East 23rd Street. CHerry 0343. **Cleveland, Ohio**

You can get BARCO SURFACE PLATES in a hurry—*Now*

MACHINE SHOP. With a Barco Surface Plate next to his machine, the operator can quickly check the accuracy of his work, correcting any error.

. . . and they're more than worth the difference

Barco Surface Plates are made of Meehanite; eliminate cast iron's disadvantages. You get uniform strength and solidity; no shrinkage or porosity; no crystal weakness or strain; great rigidity; no galling or seizing; resistance to heat and corrosion. Hand-scraped to close tolerances; heat-treated for better structure. Barco's octagon ribbing adds rigidity. Extra top thickness permits re-planing and re-scraping; 30% to 100% heavier than ordinary plates. Barcos insure faster, more accurate measurements and increased output. Users re-order again and again, considering Barco Surface Plates *more than worth the difference . . . Complete stocks, rapid-fire shipments. Try us.*

INSPECTION. Barco Surface Plates are an indispensable aid. With them you can check a variety of dimensional requirements quickly and accurately.

ALSO—Prompt shipments on Barco Slotted Angle Irons and Straight Edges. Meehanite, hand-scraped, heat-treated, speeding accurate measurements and dependable work.

Write for our Bulletin "D-7"

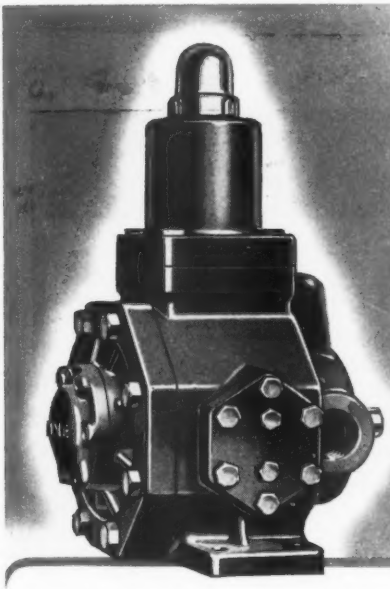
COMPARITOR. With gauges properly mounted, the Barco Surface Plate becomes a comparitor. Thousands of parts checked with minimum effort.

BARCO SCRAPING COMPANY
1975 East 65th St. CLEVELAND, OHIO

BARCO MEEHANITE MORE THAN WORTH THE DIFFERENCE **SURFACE PLATES**

SLOTTED ANGLE IRONS ★ ★ ★ STRAIGHT EDGES

Get all 3 products from one responsible source of supply.



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Variable Volume

HYDRAULIC PUMPS

A Modern Source of Hydraulic Force

With EXCLUSIVE "Vane Type VARIABLE VOLUME" FEATURE for vibrationless performance in modern machine design. Designed for long life, efficient low cost operation, these pumps are the latest "Source of Force" for metal working and industrial machinery—for clamping, forming, moulding, forcing, feeding, straightening, bending, lifting, holding and numerous other operations.

Delivery of Pump is varied by changing the position of the "True Circle" pressure ring to the rotor—pumps only the amount of oil you need to do the job—no relief valve required. Racine tilted Vane Rotor design prevents gouging of chamber ring. Vanes tend to polish the surface and cannot seize.

Because the flow of oil is automatically varied, Racine Pumps operate at reduced horsepower. Momentary shock loads are avoided, hydraulic hammering and oil heating are reduced at constant operating pressures from 50 to 1000 lbs. per sq. in.

Racine Oil Hydraulic Pumps are made in three sizes—0-12, 20 and 30 gal. per min. capacity at 50 to 1000 lbs. pressure per sq. in.

Equipped with standard automatic pressure controls; or with Solenoid, Lever or Hydraulic two pressure control; or with handwheel or lever for manual volume control.

Racine makes available to all Tool Engineers and Designers a complete service for your oil hydraulic problems. For complete information, address Dept. TD-P.

RACINE OIL HYDRAULIC VALVES

With Balanced Piston—"Sleeve Type" Construction

Exclusive honed alloy "Sleeve Type" construction provides a continuous bearing and sealing surface—piston always in alignment, cannot sag.

Valves are available in ¾" to 1½" standard pipe sizes with mechanical, electrical or manual operating device. Various porting arrangements can also be furnished to suit your requirements.

RACINE HYDRAULIC METAL CUTTING MACHINES

The Producion Saws of Modern Industry

Racine's Metal Cutting Machine line is complete for either general purpose or production cutting—Wet and Dry Cut Models. Hydraulically fed and controlled to produce fast, accurate and efficient metal cutting. Capacities 6" x 6" to 20" x 20".

RACINE

RACINE TOOL and MACHINE COMPANY

STANDARD FOR QUALITY AND PRECISION

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PRODUCTO DIE SETS

To help speed up production of tools for war production in all parts of the Country, Producto Die Sets are available for shipment from our two factories mentioned below. Also, Die Supply Company, 4747 Hough Avenue, Cleveland, Ohio.

Pacific Coast users will find stock of Die Sets and Accessories at Jamison Steel Corporation, San Francisco and Los Angeles.

Our No. 9 Die Set Catalog gives complete engineering information on Die Sets and Die Makers' Accessories.

THE PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVE., BRIDGEPORT, CONN.

3017 MEDBURY DETROIT, MICH.

The deft touch of women's hands speeds precision ground parts on...

THOMPSON GRINDERS

Women are rapidly filling the vital spots left by loyal men who have joined the various branches of our fighting services.

Thompson Grinders are easy for women to operate. Control of all power operated functions is centralized and hydraulically balanced to move at the slightest touch. Automatic wheel head feeds are standard on all Thompson Grinders. Hydraulic table feed eliminates table shock and results in a clean, smooth finished grind.

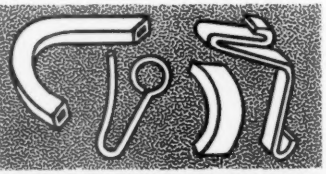
If you are faced with a man shortage problem do not hesitate to put a Thompson Grinder in the hands of a woman operator. The ease and simplicity of handling this modern surface grinder enables women operators to become efficient quickly.

THOMPSON BUILDS

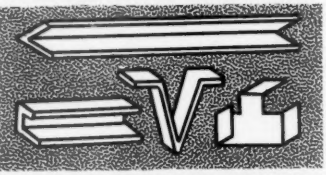
a full line of hydraulic surface grinding machines from the small tool room grinder 6" x 18" to the larger C types 36" x 220".

THE **Thompson** GRINDER CO.

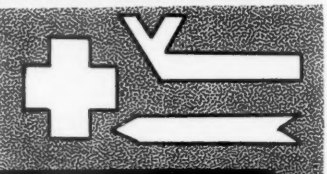
IF YOU BEND tubing, wire, channel, moulding, strip stock



OR FORM angles, channels, "vees", brackets, clips



OR TRIM stampings, strips or squares, make slits or notches

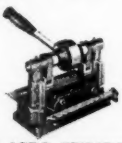


-Investigate the DI-ACRO System of DIE-LESS DUPLICATING

Do you need metal stampings or duplicated parts in a hurry? Quite probably you can make them without dies! DI-ACRO Precision Machines — Shears, Brakes, Benders—have a remarkably wide range of applications especially when 2 or more units are used in combination. In many cases they eliminate the need for dies entirely—and you have your stampings or parts in a few hours. All duplicated work accurate to .001". Put "DIE-LESS DUPLICATING" to work in your plant—it will solve many a knotty problem.

DI-ACRO BENDERS
Bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Capacity—Bender No. 1—7/32" round cold rolled steel bar. Bender No. 2 and No. 3—½" cold rolled steel bar.

DI-ACRO BRAKES
form non-stock angles, channels or "Vees". Right or left hand operation. Folding widths—No. 1—6". No. 2—12". No. 3—18".



DI-ACRO SHEARS
square and size material, cut strips, make slits or notches, trim duplicated stampings. Shearing widths—No. 1—6", No. 2—9". No. 3—12".

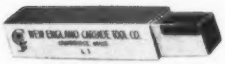
Send for Catalog "METAL DUPLICATING WITHOUT DIES"

You will find this 32-page book valuable for reference. It shows many typical stampings or parts made with the DI-ACRO System and describes how you can readily convert these STANDARDIZED units into highly SPECIALIZED machines for your own work. Write for this catalog today.

O'NEIL-IRWIN DI-ACRO PRECISION MACHINES MFG. CO.

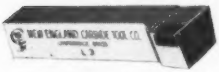
315 EIGHTH AVE. SOUTH MINNEAPOLIS 15, MINNESOTA

NEW ENGLAND *Standard* CARBIDE TOOLS

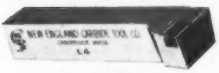


Tool Style No. 1

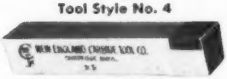
Tool Style No. 2



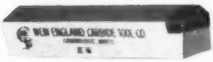
Tool Style No. 3



Tool Style No. 4



Tool Style No. X5



Tool Style No. X6

Styles 1 to 4 furnished right- or left-hand

THEY ARE PRECISION BUILT —READY FOR THE JOB . . .

ALL NEW ENGLAND Standard Carbide Tools are double checked at the factory to assure you of tools that are *ready for the job!* All tips are finish ground on diamond wheels to correct tolerances and with polished finish. You can count on NEW ENGLAND tools for long life, high production and fine work finish.

You can specify any make or grade of carbide. We will supply it and make your standard or special tools to suit your particular needs. Mail the coupon today for complete details.

TUNGSTEN CARBIDE PRODUCTS • DIAMOND TOOLS • DIAMOND POWDER

NE

TRADE MARK

SEND FOR THESE TODAY

Please send me your new Standard tool folder and a Standard tool wall chart for our tool room.

NAME _____ TITLE _____

COMPANY _____

STREET _____

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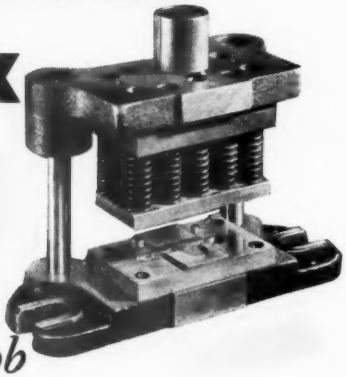
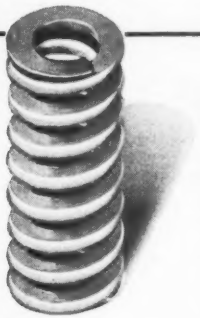
TDJ

NEW ENGLAND CARBIDE TOOL CO

FASTER, FINER DIE WORK



By using the Die Spring Tailored for the Job



WARTIME die work demands greater speed and accuracy. You can meet this demand by using the die spring tailored to the job... and to the press. Customized die springs for each particular requirement are available at Muehlhausen; in series "S" for high speed, "M" for regular speed, and "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length, from ¾ to 4 inches in diameter, and from 80 to 3000 lbs. in load capacity.

MUEHLHAUSEN SPRING CORPORATION
Division of Standard Steel Spring Company
875 Michigan Avenue, Logansport, Indiana

WRITE FOR *FREE*
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Illustrates and describes die springs in 206 sizes and types.

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SPRINGS
EVERY TYPE AND SIZE

Here's a new quality line of
STANDARD AND SPECIAL TOOLS

For an additional, dependable source of quality cutting tools write for this new Arnold Tool Company catalog today. It's just off the press and contains the complete Arnold line of standard tools plus information concerning Arnold's ability to design special tools to your specifications. Over thirty years of precision toolmaking experience assures you of a quality product and deliveries are surprisingly fast. Write at once for this 40 page catalog. No obligation.

ARNOLD
Tool Company
14469 EUCLID AVE.
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Drilling hardened steel Rolls-Royce camshaft with "HARDSTEEL" drill.

Eliminate Expensive Grinding

Drill HARDENED Steel Parts with "HARDSTEEL" Drills

● You can speed production and cut costs by eliminating grinding operations—simply use "HARDSTEEL" drills to drill, ream, countersink and counterbore steel parts hardened by any process—without annealing.

One manufacturer of push rods for aircraft engines saved $7500 annually on grinding wheels alone when "HARDSTEEL" drills made unnecessary a single grinding job.

"HARDSTEEL" drills work with ease in hardened steels—even in steels of the work hardening types. And the harder the material—the easier it is to drill.

Drill after hardening—cut your rejects—insure parts matching at assembly—by using this new drill according to the complete instructions in the "HARDSTEEL" Operator's Manual—24 pages of practical information—yours for the asking. *Write for it today.*

BLACK DRILL CO. • 5005 Euclid Ave., Cleveland, Ohio

"YOU HARDEN IT—WE'LL DRILL IT"

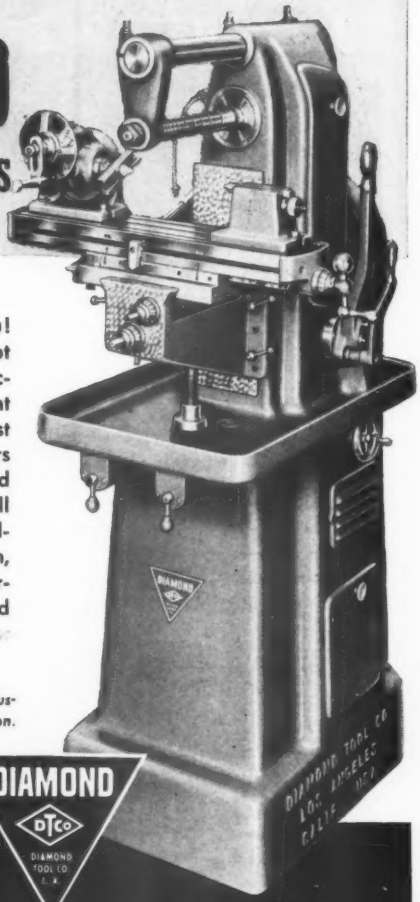
"HARDSTEEL"

DRILLS • REAMERS • TOOL BITS • SPECIAL TOOLS

Quick Delivery... Lower Cost

DIAMOND

MILLING MACHINES



We may be able to help you! Diamond's reputation for prompt delivery—as well as for manufacturing to the highest government standards is enviable. A long list of nationally important customers testify to the precision, rigidity and performance of our millers. It will pay you to investigate. Four models available. Two for production, two for tool room. Special interchangeable accessories that speed production.

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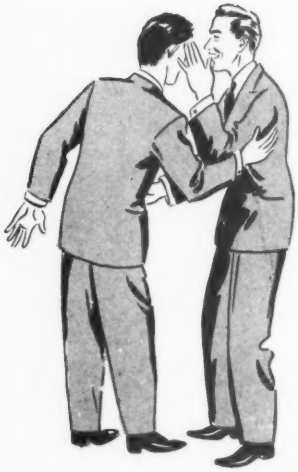
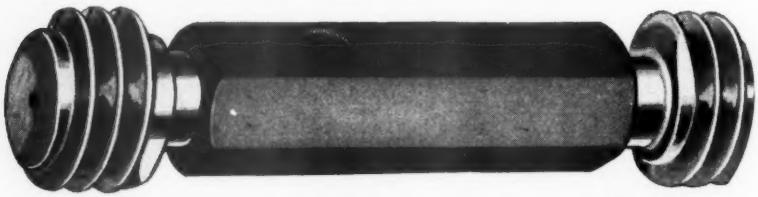


PERFEX can deliver 75% of standard *Male Thread Gages . . . . . in 48 hours!*

YES, we can still deliver standard Male Thread Gages within 48 hours and all other Perfex standard size gages can be delivered within 4 to 6 weeks from the time your specifications and blueprints are received.

A new plant, modern equipment, and experienced workmen is the reason why Perfex can make and keep their delivery promises. Why don't you find out more about Perfex's line of gages today? If you send complete specifications and blueprints on the gages you need we will see that quotations are rushed to you by return mail.



★ PERFEX manufactures Thread, Plug, Radius, Contour, Profile, Flush Pin, Adjustable Snap, Solid Snap, etc. ★

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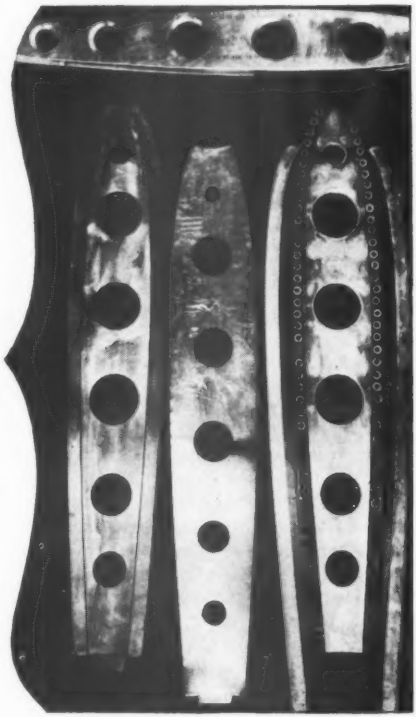
SAVE TIME · MONEY · STEEL

This photo shows how Masonite® Die Stock was used by Schlenzig Manufacturing Company, Philadelphia, to build a six-foot-long stabilizer rib mating die.



MANUFACTURERS all along America's wartime production front are saving time, money and steel by using Masonite Die Stock for special types of mating dies, forming blocks, templates, jigs and fixtures.

This amazing semi-plastic material has great compressive and flexural strength . . . stands up under present-day production requirements . . . can be fabricated in pattern or metal shops with great speed.

Only one-sixth the weight of steel, Masonite Die Stock produces dies, forming blocks, jigs and fixtures that can be easily handled in and out of hydro press or power brakes, etc., by either men or women—hoists or cranes are seldom required.

Masonite Die Stock is available in thicknesses of ¼ to 4 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. For further particulars, please mail coupon below.

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MASONITE CORPORATION

Dept. TJ-7, 111 W. Washington St., Chicago, Ill.

Please send me illustrative literature and complete information about Masonite Die Stock.

Name and firm _____

Address _____

City _____ *State* _____

Battle Strategy on DRAWING BOARDS

A McKinney built, four position, indexing jig for high production drilling of important airplane parts, to close tolerances.

LIKE the battle front, the production front also requires competent strategy.

McKinney engineers (production strategists if you please) have *designed* the tool equipment for producing essential parts of many planes, tanks, guns, etc.

And the McKinney organization, with plant and facilities for working up to 500 tool technicians, has *built* the tools for producing many machines and implements of war — all requiring split-thousandth accuracy.

McKinney tooling experience — dating since 1920— and their substantial contributions to our war program give assurance of handling your most important tooling jobs — satisfactorily and promptly.

Send us your blueprints or request the call of a McKinney engineer.

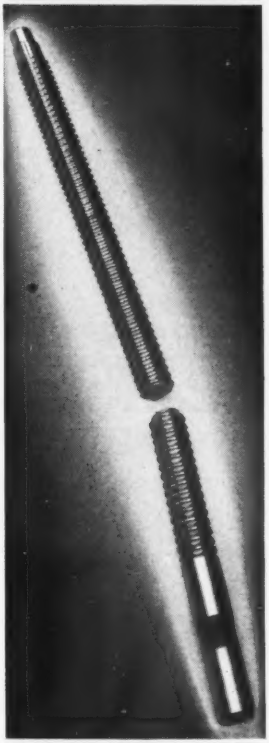
McKINNEY TOOL & MFG. CO.
CLEVELAND

DESIGN *and* PRODUCTION ENGINEERS
Since 1920

1673 ARABELLA ROAD

Tools·Dies·Jigs·Fixtures·Special Machinery

2 SECONDS
would have saved
this broach . . . . .



It may take 100 days
to get a new one

How to get more production with your Broaches------

4. BY PROPER ALIGNMENT

It only takes a second or two to make sure that the piece to be broached is PROPERLY AND SECURELY seated in the fixture.

When parts are not securely seated they may "jump" into place while the broach is moving. If this happens the part tends to "cock" and jam against the broach, frequently resulting in tooth breakage if not breakage of the broach itself.

And, when you are broaching a cored or forged hole from the rough, it is safest to use an equalizing fixture to avoid localized high tooth loads tending to force the broach out of alignment.

For the same reason, a drilled hole should be square with the face or surface of the part against which it is located in the broaching fixture.

Simple precautions such as these will enable you to reduce broach breakage, reduce tool costs, and avoid production tie-ups.

Write for a copy of "Broaching News" Vol. IV, No. 8 for further details on "How to Get the Most Out of Your Broaches".

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Broaching Machines *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

A Winning Team!

YOUR riveters will score a new high in production speed if they use these three Cleco products.

CLECO SHEETHOLDERS afford the best method of holding metal sheets together while riveting. They are 80% faster than holding screws, and exert 50 lbs. of *even* clamping pressure. The Exclusive Cleco Repair and Exchange Service permits quick replacement of damaged sheetholders.

CLECO SMALL RIVETERS include both "slow" and "fast" hitters, in many sizes and handle styles—the *right* riveter for *every* job. They strike accurately controlled blows, at the proper speed and power, causing the rivet metal to flow uniformly without structural deterioration. A complete line of Squeeze Riveters also available.

CLECO RIV-N-JECTORS consist of a magazine holding about 50 rivets that can be released one at a time into the rivet hole. Actual tests prove Riv-N-Jectors save 90% of the rivets lost when handled by hand. They enable operators to insert and drive 30 rivets per minute.

These Cleco Tools insure fast, efficient riveting with minimum waste.
Write for Bulletins 87, 85 and 89.

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3781 East 77th Street **Cleveland, Ohio**
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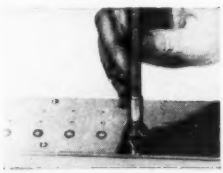
BUY U. S. WAR BONDS AND STAMPS

A popular model riveter with the BW handle

Inserting Cleco sheetholders with our latest design pliers



Inserting a rivet with the Riv-N-Jector.

VICTORY

INDISPENSABLE IN THE TOOL ROOM

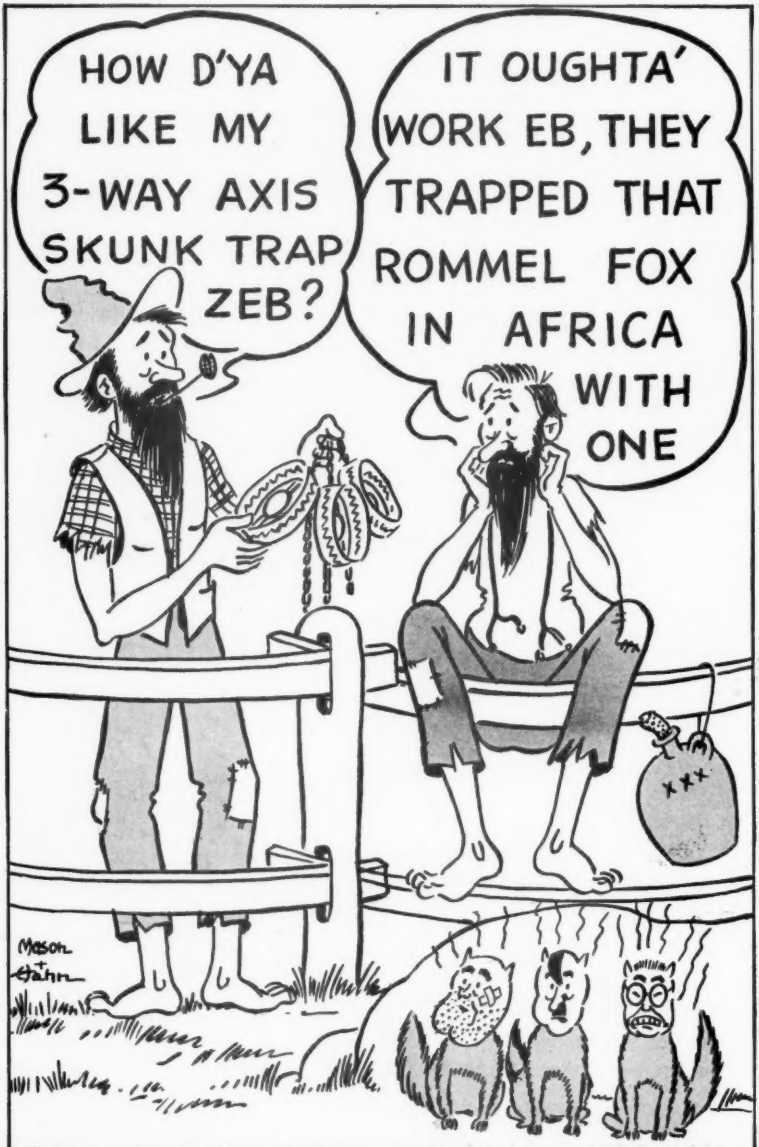
From the sands of Africa to the Land of the Kangaroo—men of many tongues operate sturdy, dependable, and accurate Cincinnati Shapers. Around the world, they produce for "Victory."

Write for Catalog N-2.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS



Perhaps you haven't a 3-way skunk trap to trap the Axis but you can help to defeat this murderous trio in conserving vital tool steels by welding your broken tools and dies with EUREKA Tool Steel Electrodes. We also feature the "SUTTONIZING" welding process for restoring your high speed cutting tools in our own plant.

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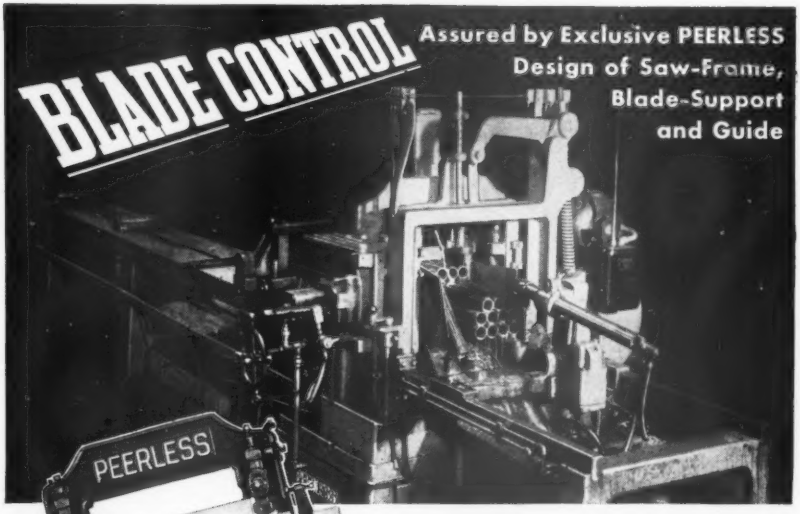
BLADE CONTROL

Assured by Exclusive PEERLESS Design of Saw-Frame, Blade-Support and Guide



A *Friendly* Suggestion

Tell us about your toughest metal cutting job. Let us send you estimate of cutting time for it, based on actual shop records of Peerless performance. Use the coupon.

Blade Control — First Essential for High Speed Precision Cutting

To assure fast cutting to close tolerance, the first essential is absolute control of the blade.

In Peerless Metal Cutting Saws, the blade is locked rigidly in place. There is no bowing or tilting, even under maximum tensioning. The Peerless Four-Sided Saw-Frame is distortion-proof. It surrounds the blade and the work. The Backing-Plate Blade-Support permits extreme tensioning with no distortion. It gives rigidity to the blade assembly. And the Saw-Frame Guide, fitted with eight bearings with renewable and precision-ground ways, assures cutting to the closest possible tolerance with no vibration or variation. Only Peerless offers these exclusive features.

You can do the job faster, more accurately and at lower cost with Peerless Metal Cutting Saws.

PEERLESS MACHINE COMPANY
1600 Junction Avenue Racine, Wisconsin

Peerless Machine Co., Dept. TD-743 Racine, Wis.
Mail cutting time estimate for.....

- ☐ Mail catalog on Hydraulic type Saw for High Production Cutting
- ☐ Mail catalog covering Vertical type used for Die Block Work
- ☐ Mail catalog on Mechanical type Saw for production cutting
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Company.....
Individual.....
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Peerless
THE ONLY METAL CUTTING SAW WITH FOUR-SIDED SAW-FRAME AND BACKING-PLATE

Fast ACCURATE *Sawing* DEMANDS PEERLESS BLADE CONTROL

SEE MORE PRODUCTION

THROUGH CIRCLE "C" SUPER HIGH-SPEED STEEL

In shop after shop, **CIRCLE "C"** is helping to break earlier high-production records.

Today's grim war-demands have revealed hitherto unrecognized advantages in using this truly **"SUPER"** high-speed steel for machining the tough, hard, alloy steels that go into America's latest weapons and equipment for victorious warfare.

There are definite applications where **CIRCLE "C"** is yielding at least 25% faster machining speeds, as compared with ordinary high-speed steels—for example, in airplane-engine production.

The new bulletin (No. SL-2005) tells more.

Send for
BULLETIN SL-2005

ARMY NAVY E

Firth-Sterling
STEEL COMPANY

Also makers of "FIRTHITE" Tungsten-Titanium Carbides for steel cutting

Offices: McKEESPORT, PA. · NEW YORK · HARTFORD · PHILADELPHIA · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

It's that

LAST OPERATION

OF THE SUNNEN PRECISION HONING MACHINE

that provides

Accuracy ★ Interchangeability ★ Super-Smooth Finish ★

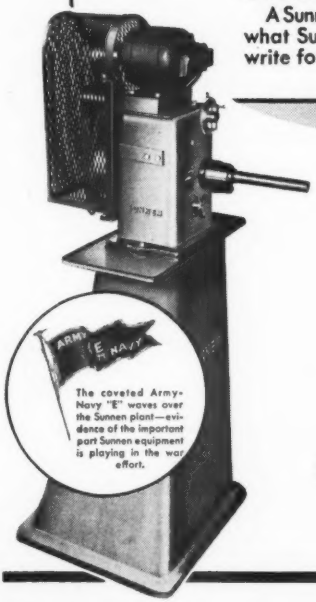
All of the care and skill used in previous operations — all of the vital materials used and the precious man-hours invested — are subject to costly waste if *that last operation* of honing or finishing is not one of dependable accuracy.

That's the reason manufacturers of precious combat equipment and munitions have been quick to adopt Sunnen Precision Honing.

For here — in a small, inexpensive, economical-to-operate piece of equipment is the method that assures interchangeability of parts and fewer rejects, thanks to a guaranteed accuracy of .0001" and a super-smooth finish of 2 to 3 micro inches.

This machine will handle any internal diameter from .185" to 2.625". No jigs or fixtures necessary. Can be set up in less than a minute. Skilled labor not needed.

A Sunnen engineer will gladly call and show you what Sunnen equipment can do on your job. Or write for free bulletin giving complete information.



The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Inner Bearing Ring "Accurately removes last tenth' of stock."

Aircraft Valve Tappet Roller. 4-Micro finish.

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Cones for Wheel Balancing Machine "Accurately align bores two interrupted surfaces."

SUNNEN PRODUCTS COMPANY

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No. 34 ABRASIVE SURFACE GRINDER

with the

VERTICAL SPINDLE

that works for

VICTORY

On many a production line, the ABRASIVE No. 34 is grinding out small parts that are unusually accurate, smooth and flat. The vertical spindle, and cylinder type wheel, speed output and cut costs in producing such work as small flat dies, washers, punches, spacers, parallels, chasers and raising blocks. Engineered and built to ABRASIVE'S high standards, the No. 34 offers many important features including the one-piece bed casting, as originated by this Company.

Ask your nearest dealer for information concerning this and other ABRASIVE Grinders—or write the factory direct.

ARMY E NAVY

ABRASIVE MACHINE TOOL CO.

Dealers in Principal Cities

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After June 1, 1943 our New England and Metropolitan New York representative will be RUDEL MACHINERY CO. with offices in New York City, West Hartford, Conn., and Boston, Mass.

Immediate Delivery From Stock

480
For Logan Turret Lathe etc.

LEVER-TYPE
Makes Obsolete All Existing Models

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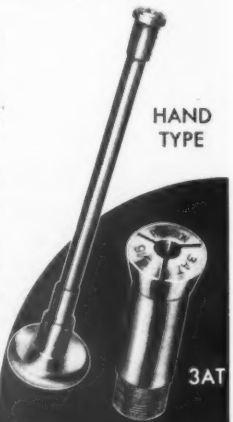
Precision Collets and Drawbars

For 10" Atlas & Logan, 9" South Bend ½" Capacity Lathes

It pays to specify *Precision* when collet work is indicated. Guaranteed unconditionally *Precision* products not only meet exacting standards of excellence, but may be had for immediate delivery.

And be sure to ask your dealer for the new *Precision* Lever-Type Drawbar. Practical men in the machine shops find it simpler to install . . . no holes to drill or tap . . . and built for superior performance. The sensational Coordinate Cam principle eliminates the need for bearings and fingers, resulting in easier operation and lasting construction. *Literature on request.*



HAND TYPE

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GENERAL DIE-STAMPING-TOOL COMPANY

PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- Production
- ★ Adaptability
- ★ Fixture Saving
- Operation Saving
- Material Saving
- Fine Finish
- ★ Flatness
- Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

Grinding bearing caps on the Blanchard No. 18 Surface Grinder.

THE surfaces on these bearing caps were formerly milled in 34 to 40 minutes each — now they are Blanchard ground at the rate of 7 pieces per hour. The Blanchard No. 18 not only increases production, but decreases setting-up time and eliminates expensive fixtures.

The caps are laid on two parallel bars on the chuck. Smaller steel blocks are laid on top of them and against the caps. Two hollow steel rings against these blocks serve to hold the work sideways. A steel block is placed at each end and the magnetism is turned on.

¼" of stock is removed from the cast iron bearing caps to limits of +.010".

The **BLANCHARD**
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

● WE MAKE THE BUSHINGS YOU NEED!

Big or small . . . long or short . . . head or headless press fit . . . fixed or slip renewable—chances are your exact requirements can be met from Ex-Cell-O's regular stock of A.S.A. Standard Drill Jig Bushings. For list of Ex-Cell-O Standard Bushings send for copy of Bulletin No. 11882-A.

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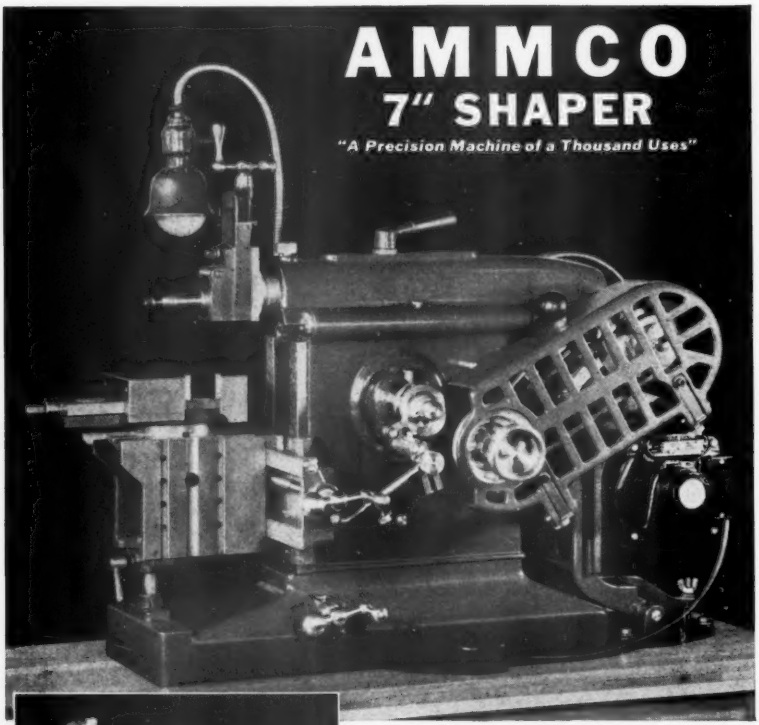
AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

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Write today for specifications and prices

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GREAT LAKES
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BROACHES...
All types
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GAGES...
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Male or Female.

MASTER GEARS and
MASTER INDEX PLATES.

You can also increase Production Speed with Broaches.

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ALCO
DRILL CHUCKS

COMPLETE RANGE OF SIZES FOR DRILLS FROM 1/32" TO 1"

ALCO Drill Chucks fit all screw machines . . . Drills are held securely without the use of bushings . . . Full floating feature of the holder insures concentric drilling even on your old machines . . . Each ALCO Drill Chuck has a wide range of adjustability so that one chuck will hold various sizes of drills . . . Produce perfect work faster.

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DON'T OVERLOAD YOUR TOOL ROOM WITH RUSH ORDERS FOR DRILL BUSHINGS - - - USE ALCO DRILL CHUCKS WHICH HOLD DRILLS SECURELY *without bushings*. MODERNIZE ALL YOUR MACHINES NOW WITH ALCO TOOL HOLDERS.

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Originators OF CHROMIUM PLATED • GAGE BLOCKS •

DEARBORN GAGE CO. • • DEARBORN, MICH.

Automatic Feed Riveting

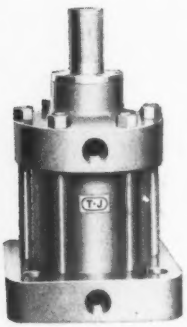
for AIRCRAFT PRODUCTION!

Designed to handle exclusively aircraft (aluminum alloy riveting) production... this new Air Powered RIVITOR averages 1600 riveted joints per hour... with no manual rivet handling. Combines Air Squeeze action with automatic feeding and setting. Soundly engineered... ruggedly built ...meets today's needs for *speed, accuracy* and *cost-cutting efficiency!* Write for new catalog RP-1.

FOR TOUGH JOBS... SPECIFY T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS



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in HYDRAULIC POWER MOVEMENT!

Get *maximum* power output and efficiency in hydraulic cylinders... by specifying T-J! Easily and quickly installed. T-J Hydraulic Cylinders avoid excessive pressure losses due to friction ...their advanced design assures that initial high mechanical efficiency is continuously maintained. Available in types and sizes to exert power movement from 1000 to 50,000 lbs. (direct). Write for Bulletin H-40. The Tomkins-Johnson Co., Jackson, Michigan.

SAVE TIME
TO SPEED VICTORY

★ BUY U.S. WAR BONDS ★

SAVING TIME is of vital importance, for every second saved hastens victory and brings us that much closer to peace.

Time is saved and precious machine hours are gained on many operations through the use of South Bend Lathes. Their wide range of spindle speeds permits machining work with maximum cutting tool efficiency. Their versatility keeps setup time to a minimum — adding hours to machine output on short runs or when product specifications are frequently changed. Conveniently placed, smoothly operating controls contribute to an ease of operation that reduces fatigue and increases manpower efficiency.

Write for your copy of Catalog 100C which describes all the South Bend Lathes.

Most important of all time-saving advantages is South Bend's dependable precision which assures maximum production even when extremely close tolerances must be maintained.

SOUTH BEND LATHE WORKS

South Bend, Indiana Lathe Builders For 36 Years

Fast, Smooth Operations . . . Stepped-up Production . . . Maximum Operator Efficiency and Safety are necessary requirements with which every manufacturer is faced today. LIMA Gearshift Drives meet all of these requirements, plus a background of Engineering Service thoroughly schooled and skilled in Machine Tool and Production Equipment motivation.

Built by the world's largest manufacturer of Gearshift Drives for unit motorization of machines and tools, LIMA gives the greatest range of sizes of any machine tool drive on the market. Why not get the most out of your production machines? Wire or write for address of Lima Engineering Service nearest you.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.

860 FINDLAY ROAD

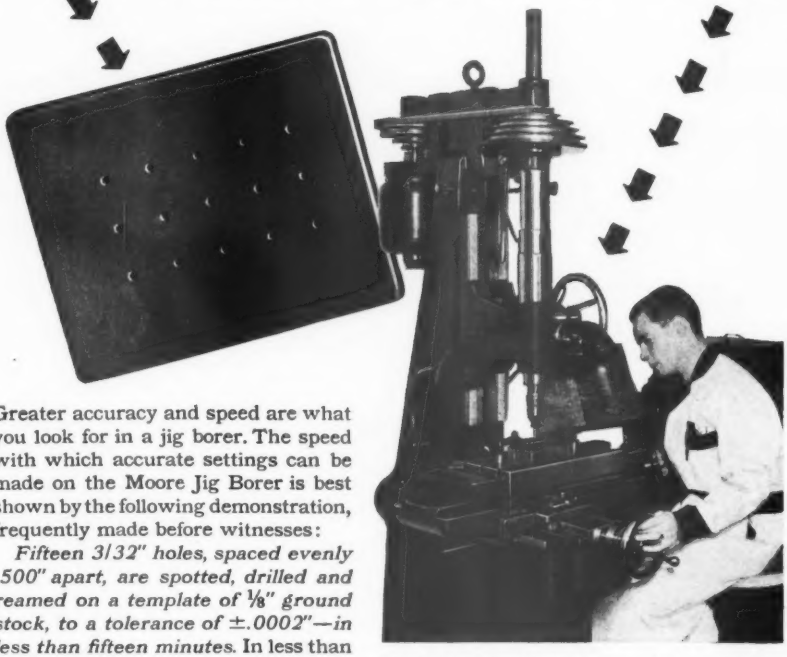
LIMA, OHIO

REPRESENTATION IN MOST PRINCIPAL CITIES

LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

15 holes in 15 minutes!

WITH THE MOORE JIG BORER



Greater accuracy and speed are what you look for in a jig borer. The speed with which accurate settings can be made on the Moore Jig Borer is best shown by the following demonstration, frequently made before witnesses:

Fifteen 3/32" holes, spaced evenly .500" apart, are spotted, drilled and reamed on a template of ⅛" ground stock, to a tolerance of ±.0002"—in less than fifteen minutes. In less than sixty seconds each hole is located accurately! If one boring cut were to be made in order to increase the accuracy to ±.0001", the time for all fifteen holes would be increased by only five minutes.

We do not believe that a similar performance is possible with any other type of jig borer. This unprecedented combination of accuracy and speed is the result of lead screws produced by us under the most advanced methods and ground to a degree of precision never achieved before. They enable the most efficient application in the Moore Jig Borer of the fundamental Coordinate Location System. By means of the two lead screws, working at right angles to each other, the workpiece may be moved into any desired position in relation to the fixed spindle. The operator can set the table instantly and check himself without fear of error.

PARTNERS IN PRODUCTION...*The Moore Jig Grinder* corrects hole distortions after hardening. Among its many operation features is the means of rapid location described above for the Jig Borer. Learn how these two machines will modernize your toolroom operations. Send for illustrated literature *today*.

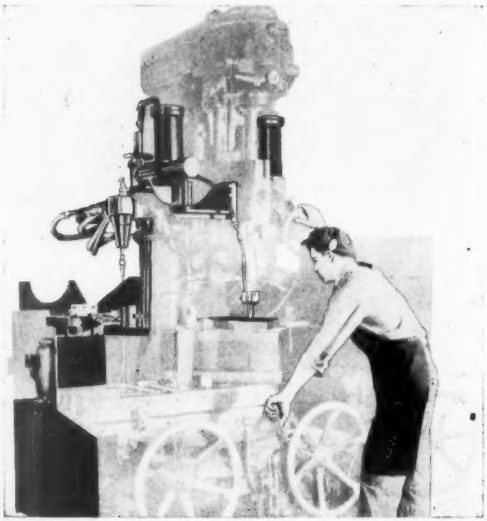
MOORE TOOLS

MOORE SPECIAL TOOL CO., INC • *Bridgeport, Conn.*

THIS DIE SINKER

Turned to Turchan

FOR *FASTER, MORE EFFICIENT* PRODUCTION!



DIE SINKING, one of the more difficult machining operations in any plant, is a comparatively simple task when the plant is equipped with a Turchan Follower.

Shown herewith is a Turchan Follower attached to a Reed-Prentice No. 5 mill. This Turchan equipped machine, located in one of the largest drop forge plants in the United States, is in almost constant use machining airplane engine crankcase dies.

One of the paramount virtues of Turchan equipment is simplicity of operation. This all hydraulic duplicator, attached quickly to any standard type lathe, planer, grinder, shaper or mill, is handled easily by any operator. The high degree of skill normally required for die sinking and other such operations is not necessary when Turchan Followers are employed.

Turchan Followers, on the other hand, do not interfere with normal use of the machine. The one pictured here can be disengaged by removing two nuts. The operators of this equipment are saving time, money and reject worries by *Turning to Turchan* You, too, can *Turn to Turchan* and do likewise. Send for our new booklet today and let our engineers explain Turchan all hydraulic duplicating to you.

TURN TO Turchan **FOLLOWER MACHINE CO.**

Originators of Hydraulic Duplicating Attachments

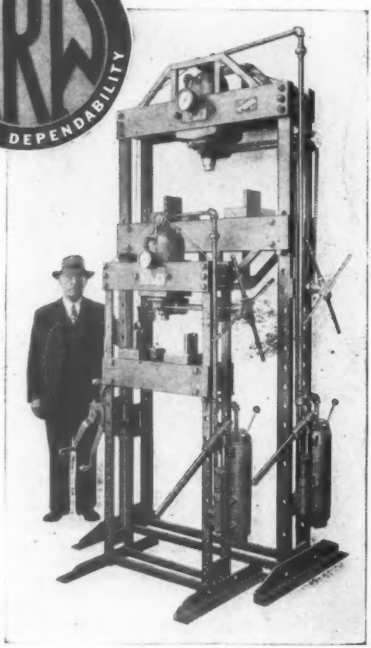
8259 Livernois Avenue Detroit 4, Michigan

KRW HYDRAULIC ARBOR PRESSES

Engineered for War Production

★ ★

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.



With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: The large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

American No. 2
PLAIN MILLING MACHINE

for
SPEED, ACCURACY AND VERSATILITY
in
ARMAMENT PRODUCTION

Infinite Spindle Speeds—25 to 500 r. p. m.

Standardized Spindle Nose. Spindle heat-treated chrome-nickel steel with No. 40 taper.

Motor in Base Drive. 3 hp U. S. Vari-Drive motor. Twin-Disc Duplex Machine Tool Clutch.

Heavy Rugged Construction. Heavily proportioned column houses motor drive and power shafts.

PROMPT DELIVERY

Spindle is heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Standardized flange spindle nose has No. 40 taper.
Controls for speed and feed are centrally located for ease of operation.

Table working surface	46" x 10¼"
Longitudinal power feed	25"
Transverse power feed	9"
Vertical hand feed	19"
Max. distance spindle to table	19"
Number of geared feeds	16"
Range per spindle revolution	.005" to .212"

WRITE FOR FOLDER

J. L. LUCAS & SON, INC.
BRIDGEPORT, CONNECTICUT

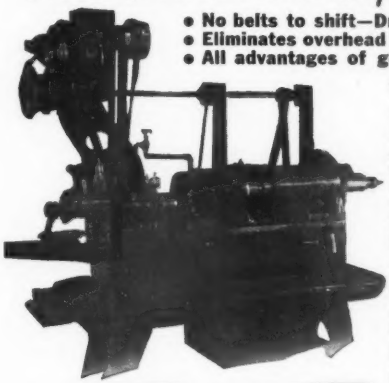
BELIEVE IT OR NOT, GENTLEMEN WE CAN MAKE ALL DELIVERIES ON TIME!

IT CERTAINLY PAYS TO INSTALL

TURNER UNI-DRIVE

Motorizes Machine Tools

These Features are Responsible:



- **No belts to shift—Drives to large step of cone at all speeds**
- **Eliminates overhead line and counter shafts**
- **All advantages of geared head with belt drive smoothness**

The high-speed, volume-production methods of wartime call for modern machines, modern methods. More speed... greater production...you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift...save time...speed up work...keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* one motor drive.

Easily and quickly installed. Increase the efficiency of machine and operator. One trial will thoroughly convince you.

Right now... today... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

IT DOES THE JOB on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Browne & Sharpe and Cleveland Automatic Screw Machines.

NOW AT WORK FOR VICTORY ★★★

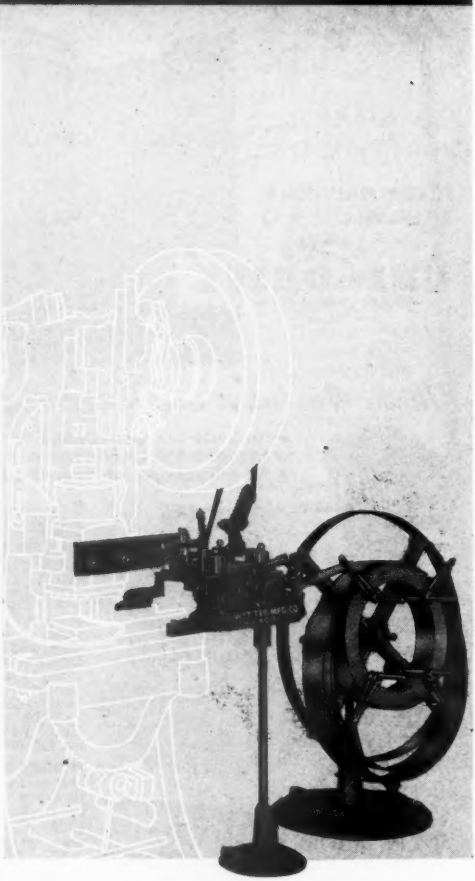
The TURNER UNI-DRIVE COMPANY
(Sales Div. Turner Machinery Co.)
3416 Terrace Street Kansas City, Missouri

PRODUCING MACHINE TOOL DRIVES • ORDNANCE TOOLS • AIRCRAFT FITTINGS

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands

Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels.

Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.



ARMY E NAVY

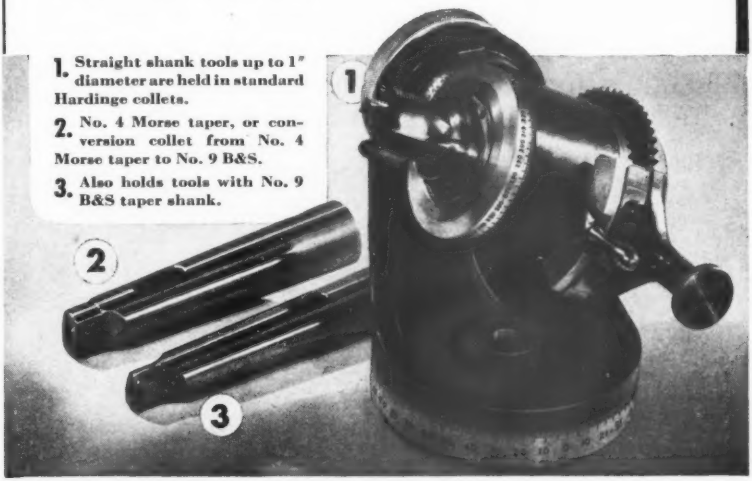
WITTEK WMCO *Automatic* ROLL FEEDS and REEL STANDS

For All Makes and Sizes of Punch Presses

The ONLY HEAD that takes 'em all!

The UNIVERSAL PRECISION INDEXING HEAD

Can be used on any tool or surface grinder. It holds all the tools shown below. Graduated 360° in 3 planes, for every simple or compound angle. Prompt delivery. *Write for illustrated circular.*



1. Straight shank tools up to 1" diameter are held in standard Hardinge collets.
2. No. 4 Morse taper, or conversion collet from No. 4 Morse taper to No. 9 B&S.
3. Also holds tools with No. 9 B&S taper shank.

CLEVELAND

TOOL ENGINEERING COMPANY

9105 DETROIT AVE. • CLEVELAND, OHIO

DETROIT REAMER & TOOL CO.

D.R.&T. CO.

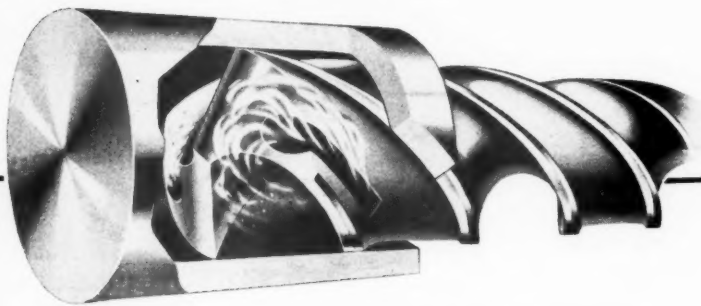
ESTABLISHED 1938

The manufacturing facilities of Detroit Reamer & Tool Co. offer the most modern present-day equipment.

Staffed with an engineering and master-mechanic personnel of widely diversified and skilled experience guarantees our patrons proper attention at all times, assuring perfect material and workmanship.

Manufacturers of

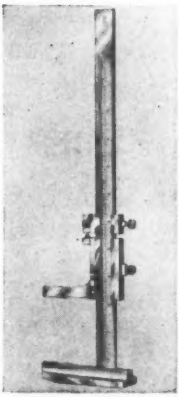
OIL HOLE DRILLS • SPECIAL REAMERS
CIRCULARITY RELIEVED REAMERS
CIRCULARITY RELIEVED END MILLS
SPECIAL TOOLS



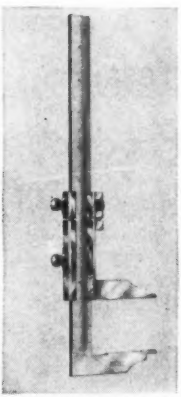
Showing one of our Specialties in oil hole drills. A sturdier and stronger drill. The 4-margin oil hole drill in actual operation.

Factory and Offices

2830 E. SEVEN MILE ROAD, DETROIT, MICH.



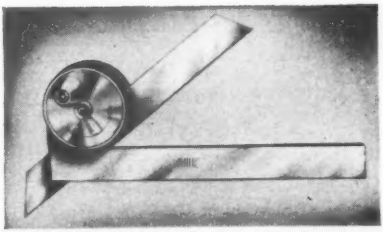
VERNIER HEIGHT GAGE



VERNIER CALIPERS

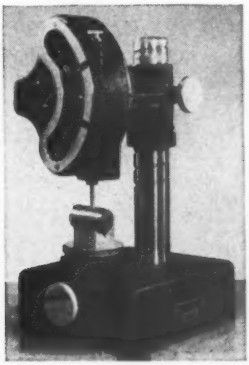
AMIC PRECISION GAGES FOR DIMENSIONAL CONTROL

Millions of parts—parts for planes, parts for tanks, parts for guns—are being produced in plants throughout the nation. At final assembly these parts must be interchangeable. AMIC Precision Gages for dimensional control are contributing to the war effort by making inspection procedures more rapid, more efficient and more accurate.

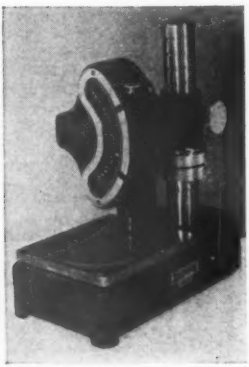


OPTO-ANGLE GAGE—Universal Bevel Protractor

OPTO-INDICATOR
Optical Inspection Gage



COMPARATOR
Precision Indicating Gage



COMPARATOR
With 6½" x 8" Serrated Table

AMERICAN MEASURING INSTRUMENTS CORP.
240 WEST 40th STREET • NEW YORK CITY, N. Y.
Manufacturers of Gages, Jigs, Fixtures, Precision Parts and Precision Units

Hundreds of Progressive and Alert Production Plants

Are Saving Time and Lowering Costs with

STATE

Boring and Reaming Bars

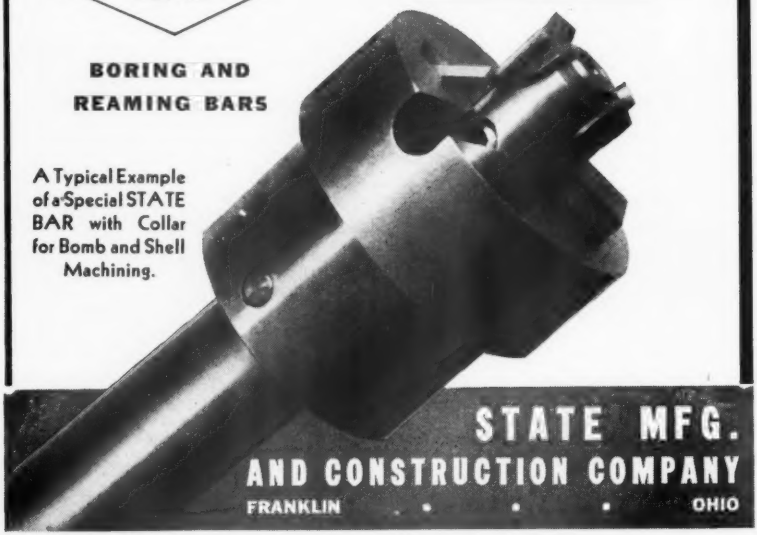
Because — With STATE'S Heavy Duty Cutting Tools Faster Speeds and Heavier Feeds can be Used.

— With STATE'S Quickly Adjusted Super-Expanding Bits, Cutting Tool Life Is Increased.

STATE

BORING AND REAMING BARS

STANDARD AND SPECIAL MODELS FOR ALL DIAMETERS 7/8" to 6"



A Typical Example of a Special STATE BAR with Collar for Bomb and Shell Machining.

STATE MFG. AND CONSTRUCTION COMPANY

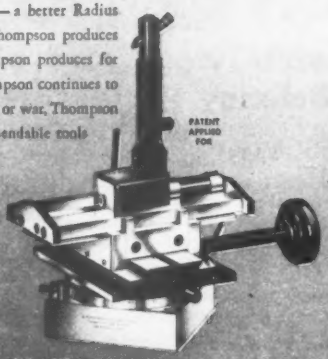
FRANKLIN . . . . OHIO

TRADE-MARK
Thompson
REG. U.S. PAT. OFF.

Announces a New
UNIVERSAL
Radius Dresser

Again Thompson produces — a better Radius Dresser — precision made. Thompson produces for our armed forces—Thompson produces for our production forces—Thompson continues to produce and improve. In peace or war, Thompson will show the way with dependable tools — produced on time.

Write for further information on this New Thompson Universal Radius Dresser.



ARMY E NAVY
Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns.

AUTO-ORDNANCE
CORPORATION
THOMPSON TOOL DIVISION

342 WEST PUTNAM AVENUE, GREENWICH, CONN.

Resists wear and abrasion . . . increases efficiency . . . assures maximum production

EASY TO HEAT-TREAT

Preheat at about 1450°F;

Harden at 2220° to 2260°F;

Quench in oil or air.

Double-draw at 1050°.

In every plant there is a tough machining job where Tungsten Cobalt High Speed Steels were formerly used. Nowadays, however, they are rapidly being replaced by the Tungsten-Molybdenum-Cobalt type, such as Latrobe's CO-6, with excellent results.

You'll find that CO-6 equals, and in many cases exceeds, the performance of the 9% Cobalt-Tungsten types. CO-6 is ideal for machining armor-plate, lathe beds, tank-rings, bearing races, car wheels, locomotive tires and other heavy-duty cutting applications where hardened or semi-hardened parts are involved. In ordering, unlike the Tungsten types, CO-6 need not be balanced with any other steel.

Heat treating is simple. There is no danger of decarburization in hardening. CO-6 will prove tougher for many uses and provide cutting edges without any tendency to flake.

Our metallurgical staff will be glad to advise on the adaptability of CO-6, described in our new technical bulletin. Write for your copy.

LATROBE
ELECTRIC STEEL COMPANY
MAIN OFFICES and PLANT . . . LATROBE · PA·

WE DELIVER ON TIME

Yes

CHICAGO GRINDING WHEELS

The wheels of proved quality—known for performance, cutting and long life. Any shape, grain and grade, any size up to 3" in diameter. From this army of wheels you can select one custom built for your job.

No holding up vital jobs while you wait for your grinding wheels or mounted wheels*.

Timing and scheduling are everything now. That's why our streamlined QUICK SERVICE is such an important asset.

Fully approved and endorsed by W P B, here's our wartime speed setup:

- Manufacture only wheels 3" in diameter and under. To speed production, larger sizes are eliminated for the duration.
- No quitting whistle. We are on the job making wheels 24 hours a day, every day.
- Our central location brings us closer to many plants. No time lost in transfer connections or long distance shipping.

TRY ONE—Tell us the kind of equipment, the job, and size wheel you want to try. We'll send it postpaid.

Catalog Mailed on Request

AMERICA'S HEADQUARTERS FOR MOUNTED WHEELS SMALL GRINDING WHEELS

CHICAGO WHEEL & MFG. CO.

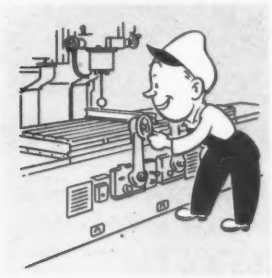
1101 W. Monroe St. Dept. TD Chicago, Ill.

*Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

You Can't Produce With Materials
THEY MUST BE FABRICATED

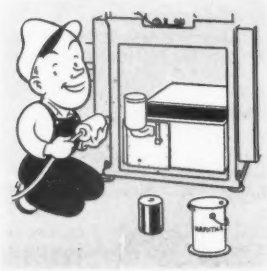
IT TAKES more than steel, aluminum, magnesium and rubber to make fighting and defense equipment. Admitedly, many basic materials are the first requirement, but they must be cut, bent, shaped, moulded, cast and so on by *machines*. And a machine which is out of commission can do no work; the materials remain as inert chunks of matter.

To keep machines in first class operating condition, follow a mechanical fitness program, with dogged attention to basic and seemingly obvious details. Some of the details to keep after on CINCINNATI Vertical Hydro-Tel Milling Machines are tabulated on the following page:



Left: Check the accuracy of level, both table and rear base, at about two month intervals. Accuracy begets accuracy.

Above: Check oil levels daily and maintain an adequate supply of clean oil in the reservoirs. "Starved" pumps can exert no more effort than starved people.



Left: Periodically remove and clean all filters; (cloth filtering type for table way oil; metallic type for hydraulic oil; stone filters added for machines equipped with profiling unit.) Wash in naphtha or similar cleaning fluid. Use emery cloth for stone filters; blow out metallic and stone filters with air blast.

THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . SURFACE BROACHING MACHINES . . CUTTER SHARPENING

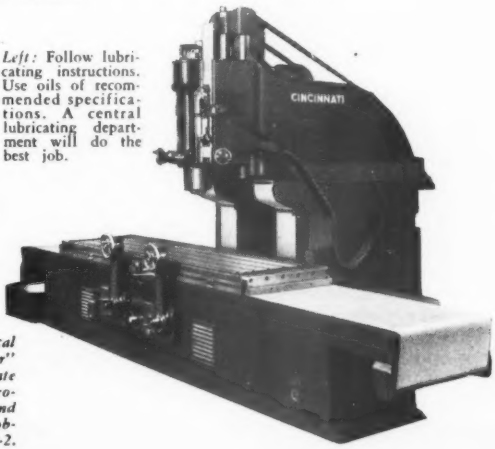
Alone . . .

BY MACHINES—

1. *Level the machine periodically.* A good rule is to check the accuracy of level every two months, of both table and ram.
2. *Follow lubricating instructions.* A lubricating schedule tag tied to the machine will serve as a convenient reminder.
3. *Use clean containers for oil,* especially for the hydraulic oil.
4. *Clean the oil filters periodically.* This is very important for hydraulic oil filters, both cartridge and stone types.
5. *When not using power feeds place feed series lever in "SLOW" position.* Eliminates wear in one spot.
6. *Always stop spindle drive motor before changing spindle speeds.* Save the gears.

These chores are simple and easy to do, and require little time. Make them a habit and avoid the ills fostered by neglect of large hydraulic machines . . . chatter of traveling units . . . inaccurate work . . . low power efficiency . . . uneven traverse . . . no response to movement of levers. Give your Hydro-Tel a break . . . give it a chance to make a production record equal to your attendance record.

Left: Follow lubricating instructions. Use oils of recommended specifications. A central lubricating department will do the best job.



Right: ***CINCINNATI 28" Series Vertical Hydro-Tel Milling Machine. A "bear" for heavy stock removal, with a delicate "feel" for accurate die-sinking and profiling jobs. Complete description and engineering specifications may be obtained by writing for catalog M-1018-2.***

CINCINNATI GRINDERS INCORPORATED CINCINNATI, OHIO, U.S.A.

MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

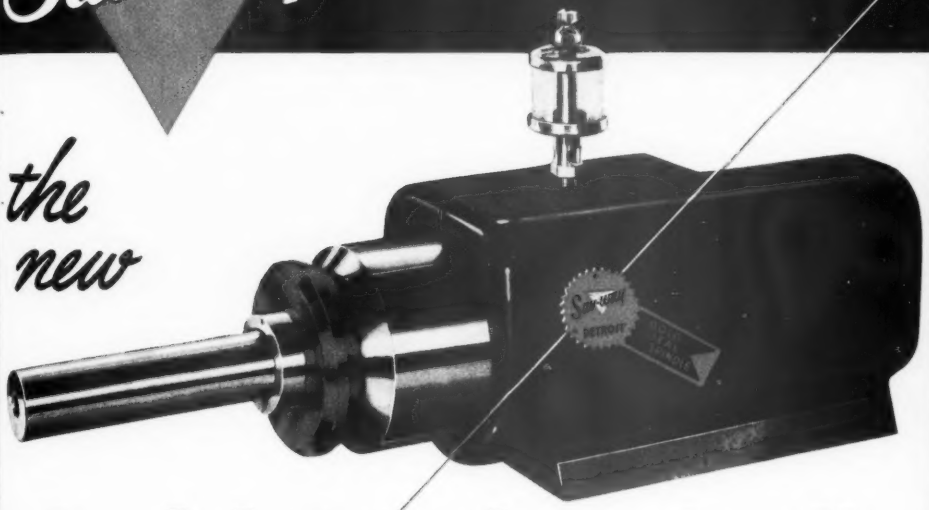
Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular
DEVLIEG MACHINE TOOLS

Sav-way announces



the new

Gold Seal Spindle

The Spindle that Breathes!

In the Gold Seal Spindle an ingenious modification of the oil intake admits an air-oil mist, through filters, to the body around the shaft. This lubricating mist is constantly drawn through the moving parts, fore and aft, by the pumping action of the exclusive Sav-Way centrifugal labyrinth seals. This flow automatically excludes dirt and coolant from the spindle.

Maximum service life is further assured by holding torsional vibration and unbalance to an absolute minimum. The rigidity essential to smooth running, high accuracy, and satisfactory finish, is achieved by using the finest of selected extra-precision bearings, applied in pre-loaded duplex pairs. The massive housing is engineered to provide automatic compensation for contraction and expansion. All component parts are deep-frozen to eliminate strain and provide accelerated ageing, with the result that precision alignment is permanently maintained.

The Sav-Way Gold Seal Spindle—the spindle that breathes—has already won its laurels in round-the-clock war production. It will do the same kind of efficient, trouble-free job in your plant!

For a Pre-view of the New Gold Seal Spindle, Attach this Coupon to your Letterhead.

SAV-WAY INDUSTRIES
Box 117, Harper Station (13), Detroit, Michigan
Please send detailed description of the Gold Seal Spindle.
Name _____
Firm _____
Address _____
City _____ State _____

Keep an Eye On

Sav-way INDUSTRIES

Machine Tool Division

4875 EAST EIGHT MILE · DETROIT, MICHIGAN

GET TO THE POINT

for Accurate Readings

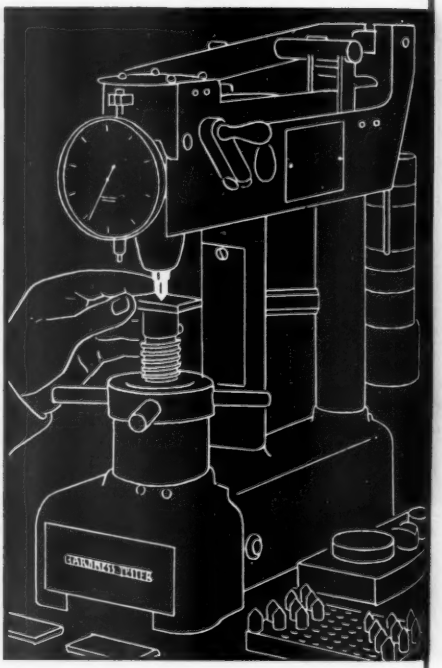
No reading of a hardness testing machine can be more accurate than the accuracy of the point itself.

Research and actual use have proven that the pyramidical or conical shaped diamonds of the Penetro Penetrator are the only shape that can give perfect readings all the time in every make of hardness tester.

This accuracy is obtained through the action of the point in penetrating metal; the stone's shape insures absolutely equal extrusion, or displacement of the metal, thus maintaining equal resistance to pressure and preventing drift of the point from a vertical axis if a hard or soft is encountered.

The quality of Industrial Penetro Penetrator begins at the very first step and continues throughout its manufacture.

Send for illustrated literature giving full details. It will pay you to have this information. Write today.



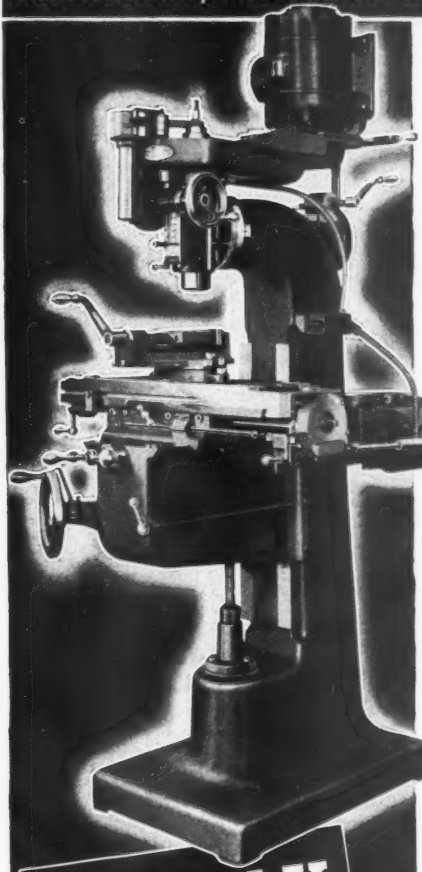
INDUSTRIAL DIAMOND COMPANY, INC.

7 Avalon Ave. **Detroit, Mich.**

DIAMOND DRESSERS · CUTTING TOOLS · DIES · POWDER SAW BLADES · BEARINGS · WHEELS · POINTS

INDEX MILLS

Manufactured by Index Machine and Tool Co., Jackson, Mich.



CHECK THESE FEATURES!

★ Precision Ball Bearing Spindle that will require no attention for two years.

★ Swivel Head which can be set 90° right or left.

★ Super construction sensitive enough to do work with end mills 1/8" diameter yet rugged enough to use 3/4" end mills taking full cuts 24 hours a day.

★ Verniers for locating, and power feed to spindle for boring.

★ A versatile machine that can be used in the tool room or on the production line.

Send inquiries for immediate quotation and quick delivery to Factory Sales and Distributing Agents.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICHIGAN

HOVIS

The New Economy Method of Making Washers

UNIVERSAL MASTER WASHER DIES

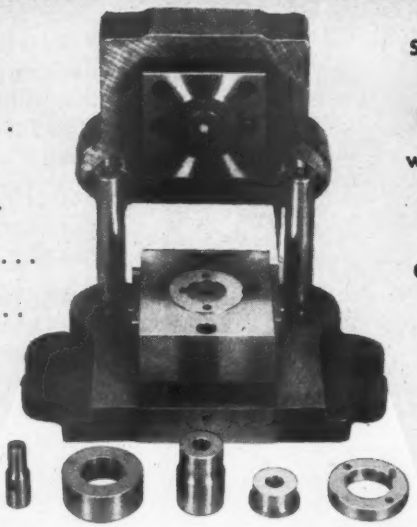
ELIMINATE:

All Process Engineering . . .

All Tool Designing . . .

All Tool Making . . .

All Die Tryout . . .



Simply tell us the size of Washer you want to make and we will furnish the Complete Set of Tools.

Hovis makes four sizes of Master Washer Dies. Each die is complete in itself, ready to use, and is made on an all-steel precision standard die set and comes complete with stock gauges and stops. From these dies it is possible to remove five small interchangeable parts without dismantling the die. These parts are held in place by the patented Hovis Screwlock principle, the same as is used in holding interchangeable punches and button dies. Once the initial investment is made in Master Washer Dies of the sizes to meet your requirements, five small interchangeable parts are the only parts necessary to purchase in order to make any size washer. Write for Folder.

HOVIS SCREWLOCK COMPANY

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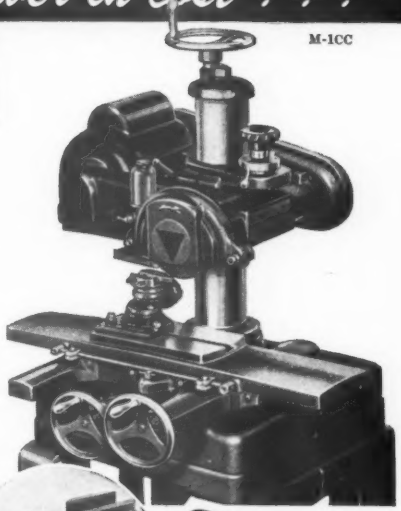

In grinders costing many times as much, you do not find many of the new, exclusive features you get in this latest Delta machine. It's husky, solid (weight 700 pounds), over 6 feet high, an accurate machine designed to turn out a big volume of work. Yet its cost is amazingly low.

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• • •

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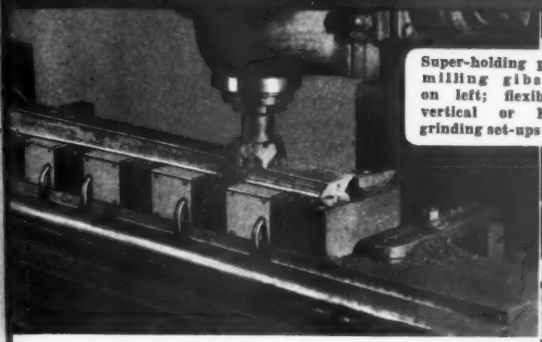
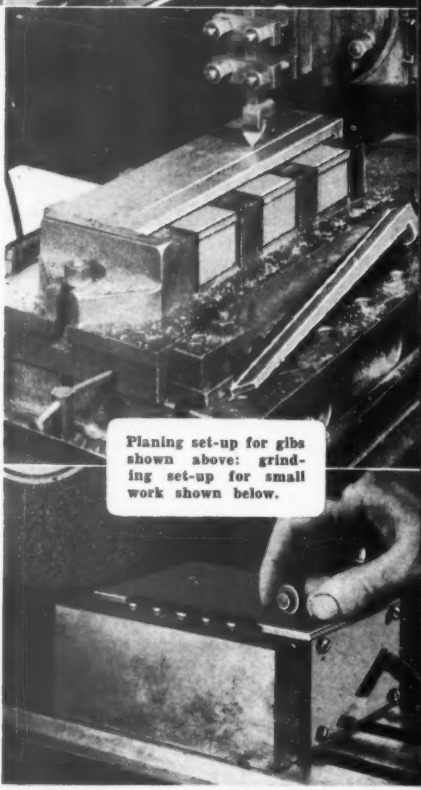
MAGNETIC HOLDING METHODS



THE BASIC UNIT

Super-holding power for milling gibs shown on left; flexibility for vertical or horizontal grinding set-ups on right.



Planing set-up for gibs shown above: grinding set-up for small work shown below.

New Holding Applications

Methods engineers in many war industries have applied the ANDERSON & BROWN Magnetic Chucks with the "Body Flo" magnetic holding method to solve many tricky holding problems as well as speedy handling of work.

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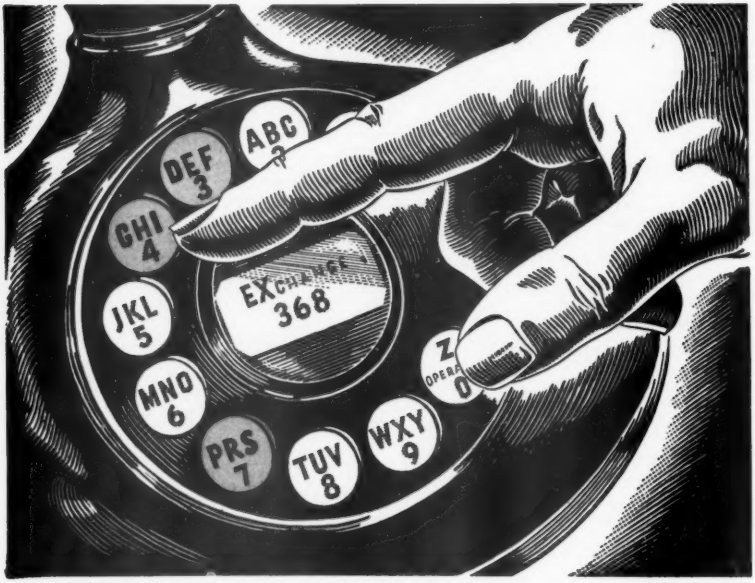

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RIGHT *makes* MIGHT

Reduced to its simplest terms, the doctrine of Nazi Germany and of pagan Japan is that a strong nation has the right to take by force what a weaker nation cannot defend.

This vicious practice is not new. History records it throughout the centuries as the false doctrine that might makes right. It is the millions of citizens who comprise the United Nations who have undertaken to prove for all nations, and we hope for all time, that it is Right which Makes Might.

Internationally considered The United States is admirably fitted to lead in this effort. Before this war we bore no ill will toward any nation. Many of our citizens have for years believed sincerely in the Good-Neighbor Policy. Others asked only that we be permitted to follow our peaceful pursuits.

For several centuries America was the pot of gold at the end of the rainbow for millions who looked toward its shores. And as they came, many contributed talents and their brawn to make us the Great Nation of Industry that we are.

Capital and labor together have built American Industry. In turn, Industry has made it possible for the families of millions of American workers and small and large businessmen to enjoy a higher standard of living than do any other peoples anywhere in the world. It was The United States of America that fulfilled the hopes of many of those who looked for the rainbow's end.

But what is of far greater importance today is that the products of American Industry, this child of the Free Enterprise System, are turning the tides of battles on all war fronts.

As this is being written we have begun the invasion of Europe by way of Sicily; we have pulverized Munda, key to the conquest of the Solomons; we are neutralizing Kiska's defenses preparatory to taking over; and along other fronts we are engaging in the tremendous aerial operations which foretell vital, new strategy. We have the evidence that American planes, guns, ships and men are on hand and ready.

In comparison with our State-of-Being at the time of our active entry into the world conflict, we of all the United Nations had the least to gain materially. Our purpose was plainly stated. In substance it was that we no longer could stand by and see still more of the world fall under the murderous assaults of three outlaw nations trying to prove this false doctrine that might makes right.

Within a few months we were to feel the impact of such an unprovoked attack. Under the painful smarting of our own burns, which after all were minor in comparison with those of some other nations, we wanted in our determination to give of our earned wealth and our free labor, any amounts necessary to make the implements which could completely demolish those made by nations ensnared and enslaved by the delusion that physical prowess is omnipotent.

Thus today we seem to be standing on the threshold of the day when we shall be able to prove that Right Makes Might. According to the prophetic words of Thomas Jefferson: "Even should the cloud of barbarism and despotism again obscure the science and liberties of Europe, this country remains to preserve and restore light and liberty to them. In short, the flames kindled on the 4th of July, 1776, have spread over too much of the globe to be extinguished by the feeble engines of despotism; on the contrary, they will consume these engines and all who work them."

Editor and Publisher

This message comes from Washington where Mr. Huebner is serving as Chief of the Tooling Branch, Facilities Bureau, War Production Board.

MODERN DESIGNS FOR DRILLING JIGS AND TAPPING FIXTURES

Yoke Clamps Work At One End

A CHEAP, simple, and quick work fastener, illustrated in Fig. 103, holds round, square, hexagonal, or other cross sectional shapes of rods for side drilling holes in them. The principle used is a swinging yoke that has a central clamping screw. There are no reasonable limits in the diameters or lengths of work, or the number of holes that can be drilled around a length of rod by using this principle of clamping.

C. W. Hinman
Designing Engineer

"Swing-bar" Clamps

In Fig. 104, two holes are drilled through the sides of a round shaft. One end of the shaft is assembled in the center of a toothed wheel. The position of the holes in the shaft must have a definite relationship to the position of the teeth, as indicated by the notched gage block in the sketch. The shaft length is centered in a V-block, and screw *B* is tightened on the shaft before screw *C* has been fully advanced. These conditions ensure the correct position of the work before drilling. However, if the shaft is very long, an auxiliary screw is placed at point *D*. The jig body is hardened and its working surfaces are ground. Bushing plate *D* is an unhardened steel plate.

Clamping Tubular Work at One End

An unusual method for clamping tubular work quickly is illustrated by the drilling jig in Fig. 105. Here is a cam clamp that locks near its "dead-center" point, and against the end of a round tubular section of work. A slight variation in the lengths of the tubes permits using round rod and is used for opening and closing the cam. This type of drill jig will also take a variety of cross sectional shapes of any reasonable lengths. By arranging suitable screw and dowel holes in a longer base body, cam holder *B* can be moved out to permit the insertion of increased lengths of work in the same jig.

Double Plate Jigs

When drilling deep holes, drills usually depart from a true perpendicular line after reaching a depth of about three times the diameter of the holes. This fault is called "running out." It may be corrected and practically straight holes obtained by drilling half way through the work from each side of the jig, as is done in the tool shown in Fig. 106.

The work drilled in this jig has a notch that extends its entire length, and to prevent placing the work in wrong position the three bushings on the right

This article begins a new series by C. W. Hinman on Drill Jigs and Tapping Fixtures. As indicated from the excellent material in this article, the new series promises to be unique. Considerable material that has never been published in any form will be presented to play its part in increasing production. As much space as possible was given to the drawings to make the article of greatest value.

are extended into the notch. Ends of bushings should not be more than one drill diameter from the work if accurate drilling is expected. Bushing ends should be close up to the surface where the drill enters, therefore all three of the bushings are extended. In cases where this cannot be done, because of a narrow recess at the hole entrance, removable slip bushings are then resorted to. Slip bushings are aligned in a liner bushing which is press fitted in the jig.

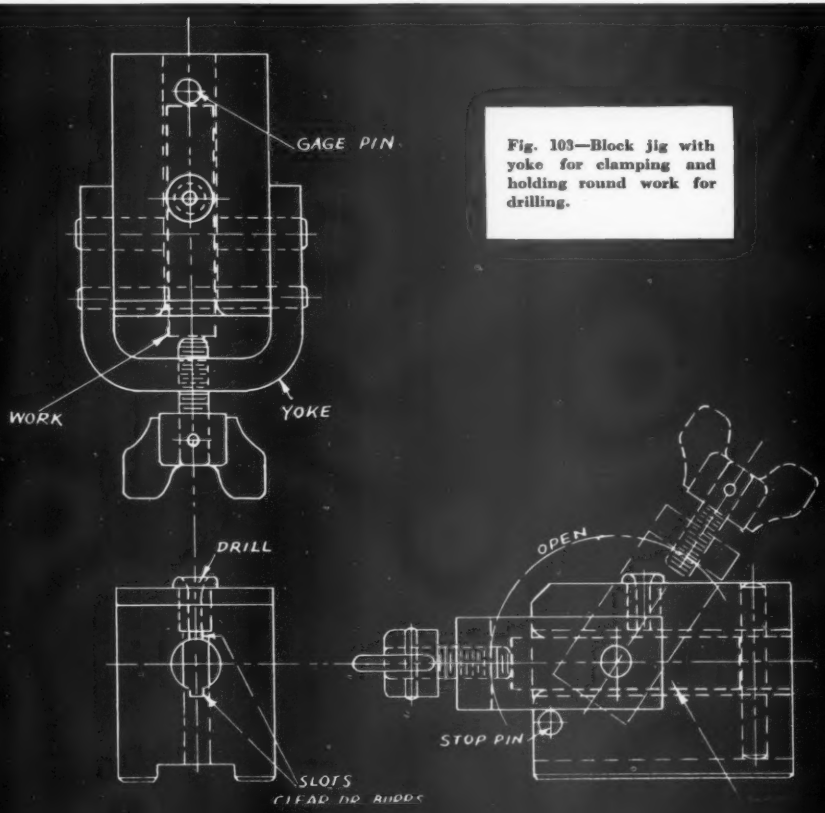


Fig. 103—Block jig with yoke for clamping and holding round work for drilling.

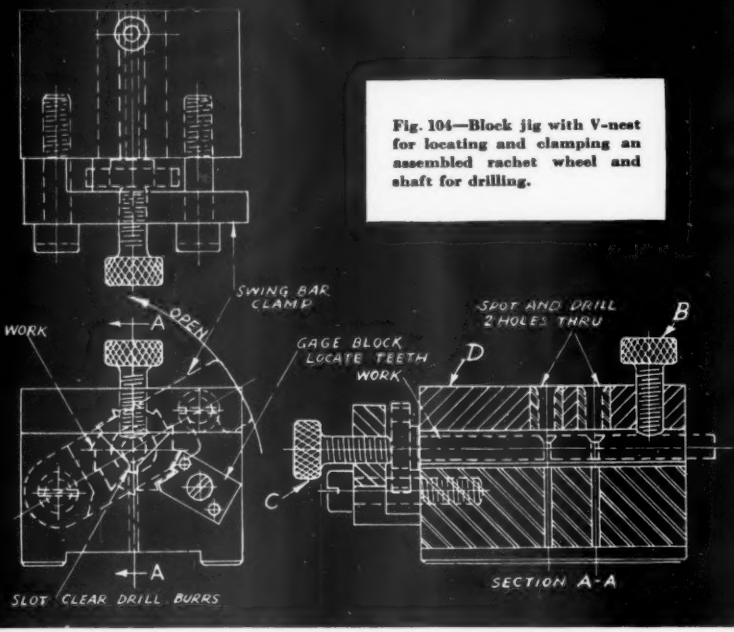


Fig. 104—Block jig with V-nest for locating and clamping an assembled rachet wheel and shaft for drilling.

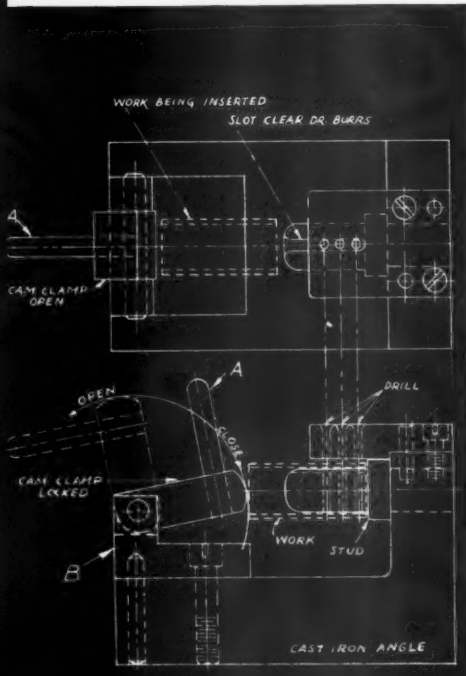


Fig. 105—Angle and stud jig with an unusual type of cam clamp that holds tubular work for drilling.

"Pump-Jigs"

Figure 107 represents a universal jig that is sometimes called a "pump-jig." The work to be drilled is an airplane engine bearing and a great quantity is required. Pump-jigs are a commercial product and are manufactured in a variety of styles and sizes. These jigs do accurate drilling and are fast to operate. Bushing plate *A* is raised or lowered, for inserting and clamping the work, by operating the crank handle at the right. Movement of the crank revolves an attached shaft and a pinion behind each of the two guide posts *B*. The pinions are in mesh with a rack of gear teeth cut in the guide posts.

The invention of this type of jig body achieved practically the same advantages in drill jig construction as die sets did for punching. Many types of drill jig designs can be built into the set. It standardizes the jig body and eliminates the time and expense of building it in the shop. Also, these jigs are particularly well adapted for drilling holes in the ends of long pieces of work by using a table support for the work that extends out in front of the jig. Some of the parts used in bomb sights are the long types, and are accurately

drilled, counterbored, and reamed in pump-jigs. Universal jig sets are now largely employed in drilling parts used for war equipment.

Multiple Drilling of Stacked Parts

The double plate drill jig sketched in Fig. 108 is used for "stack drilling" several parts of plate work in one setting. It can be designed for small parts to be drilled either in a single or multiple spindle press, or for drilling large blanks which have been routed out for aircraft assemblies. Some parts for aircraft are so large, and the jig so heavy that it must be leaned against a vertical support, and the bushing plate must be handled by an electric hoist. The base plate is the "back-up" against which the work sheets are loaded and finally drilled. For very large work the base plate is made of Masonite, and the bushing plate is built up of welded-together slats in order to avoid excessive weight. A single spindle portable hand drill is used for drilling, and six or more draw-bolts and wing nuts are necessary for clamping.

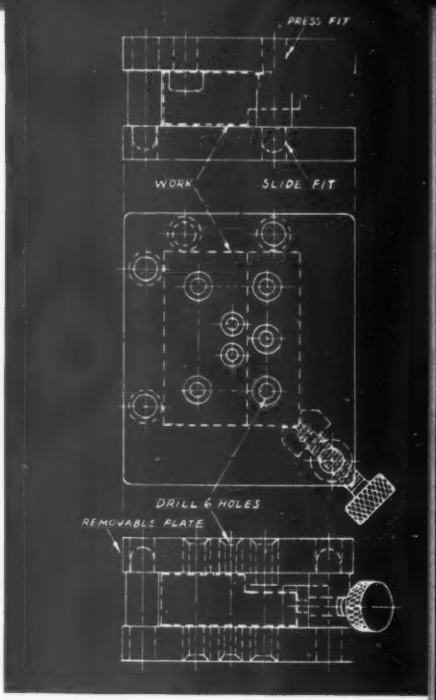


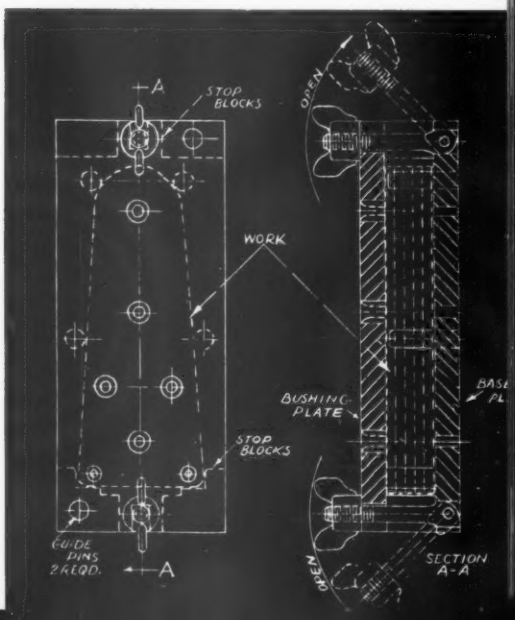
Fig. 106—Double plate drill jig for drilling flat thick work, half way, from both sides.

COMING . . .

The entire series by Mr. Hinman on Drilling Jigs and Milling Fixtures is being prepared in booklet form. Dozens of practical examples have been given together with over a hundred excellent drawings and illustrations. The book is now in process and should be ready in about thirty days.

Mr. Hinman is also author of the books "Practical Designs for Drilling and Milling Tools" and a new book, "Die Engineering Layouts," both published by McGraw Hill Book Co. His long and varied experience qualifies him to write authoritatively on tooling and production subjects. We appreciate this opportunity to submit the past series of articles in a more convenient and permanent form.

Fig. 107—Double plate drill jig in which accuracy of the work is unimportant and all the drilling is done from one side.



APPLICATION OF MEEHANITE TO DIES AND MOLDS

C. E. Herrington
Meehanite Research
Institute of America

DURING the past few years, a great number of dies of Meehanite metal have been furnished to the various stamping and forging industries, die casters and molders.

The first metal dies were undoubtedly made of cast iron, and as Meehanite metal is a development of a cast metal, it is also a metal suitable for use as a die material.

Meehanite metal metallurgically occupies an intermediate stage between cast iron and steel, characteristics of the former and limited characteristics of the latter being present in a controllable form.

perficial surface hardening-nitriding.

Cast-to-Form Dies and Molds

The major number of Meehanite Metal dies and molds are cast to form.

In practically all cases of the larger dies, this is possible.

Sometimes there is improvement in the physical properties of die cast to form, over dies machined from a solid block when deep machining is necessary. Cast-to-form dies produce clean stampings or castings, without flash lines, die marks and surface scratches. Dies may now be cast

TABLE 1

Physical Properties	Ordinary Gray Iron	As Cast Meehanite Types GA-GM	Meehanite Heat Treated	Low Carbon Cast Steel	High Carbon and Alloy Steel Heat Treated	Properties Desirable in Dies
Tensile—lb. p.s.i.	32,800	50,000–55,000	70,000–(min) 80,000	70,000	134,400	High tensile strength
Yield Point lb., p.s.i.	32,800	47,000–50,000	56,000–64,000	37,500	156,800	High yield point
Compression lb., p.s.i.	100,800	175,000	202,000–260,000	96,320	224,000	High compression strength
Ductility	Nil	Very slight	Very slight	Good	Satisfactory	Ductility questionable in value
Coefficient of friction against steel	.1876	.1959	.1959	.28	.26	Min. coef. of friction desirable
Wear resistance	Fair	Good	Very good	Fair	Very good	Max. wear resistance desirable
Castability (if cast)	Very good	Good	Good	Fair	Forged	Good castability
Solidity through sect.	Fair	Very good	Very good	Good	Very good	Solidity necessary
Machinability	Very good	Good	Good	Fair	Fair	Machinability necessary

Meehanite dies may be heat treated to give improved physical properties. The usual forms of heat treatment are quench and tempering operation affecting the whole of the die; surface hardening, a shorter process-may be local or embracing whole of surface of die; also a quench and tempering operation, su-

to such fine limits that scraping and burnishing are only necessary prior to being placed in service.

Performance records from a large number of die applications have been carefully considered. These include all dies and molds used in stamping, die casting, plastics molding, and rubber

(a) *Description*

DIE or MOLD

(b) *Operation on which employed*

Blanking	Gravity die casting
Forming	Pressure die casting
Extruding	Plastics press
etc., etc.	Rubber molding

(c) *Actual component*

Top die
Bottom die
Die ring
Punch
Draw ring, etc.

(d) *Stock on which to operate*

Iron-Wrought-Tinplate	Alloy and composition
Steel-Mild or Stainless, Etc.	
Aluminum and alloys	
Copper and alloys	

(e) *Form of stock*

Billet	Liquid condition
Sheet	Pasty condition
Strip	Powders
Plate, etc.	
Bar	

(f) *Dimension of stock*

Thickness, and other dimensions where applicable.	Size or weight of shot

(g) *Temperature of stock*

(h) *Temperature which die normally attains.*

(i) *Is provision made for cooling?* (Means employed for cooling—Air or liquid—Internal or external)

molding. They include also other operations in which dies or permanent molds are used.

A metal suitable to resist the effect of abrasion is not necessarily a satisfactory material for erosion resistance. The most suitable structure to resist the effect of abrasion may consist of hard abrasion resisting particles set in a matrix of relatively soft material, such as in the case of bearing and anti-attrition metals, and also, of course, in the ferrous materials such as special cylinder metals, in which the hard phosphide network of the Fe3P is developed or the presence of a hard pearlitic constituent may be surrounded by softer ferrite or graphite particles.

These examples would be useless for resisting erosion as they rely upon the hard particles taking the wear, whilst the softer material acts as a cushion and lubricant reservoir—a die may be lubricated—not so a permanent mold. To resist erosion a uniformly tough and relatively hard face is necessary—a uniform fine grained structure being of paramount importance, in order to resist the mechanical wear of a material at a high temperature in the liquid or plastics state in which solid particles may be present.

In the following examples the special features or outstanding requirements only are given, as all castings must obviously provide an adequate degree of the certain general service requirements. These include tensile strength, compression strength, toughness or resistance to impact, resistance to abrasion, resistance to erosion, resistance to corrosion, rigidity and permanence of shape, fine grain structure, machinability, ability to take high polish, heat resistance, maintenance of strength and shape at high temperatures, and freedom from scaling, growing, spalling, heat checks.

To the principal or major requirements, therefore, an appropriate degree of these more general properties must be assumed.

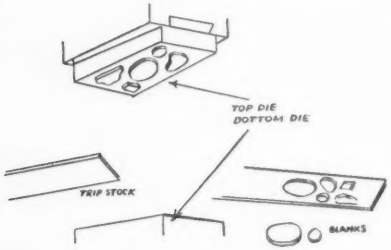
It must also be borne in mind that many processes involve the simultaneous operation of a combination of the basic operations enumerated.

Blanking is the operation of cutting out by stamping or pressing flat blanks to required shape, prior to drawing or forming, as shown in Figure 1.

Form of material used can be strip or sheet, usually cold. A number and variety of shapes may be mounted together in order to leave the minimum of waste and material. Pressure may be applied rapidly.

Special service requirements demand that a sharp cutting edge must be maintained without chipping or becoming saw edged—being tough rather than brittle hard.

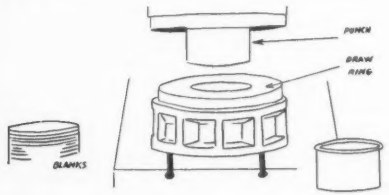
Type GA Meehanite heat treated to produce a tough structure and with a 350 Brinell proved entirely satisfactory



for this type of operation with, however, definite limitations as to the material being blanked.

Drawing and Cupping

This process, illustrated in Fig. 2, involves a deep and severe drawing operation, where a definite flow of material



takes place rather than a mere stretching, as in the case of forming.

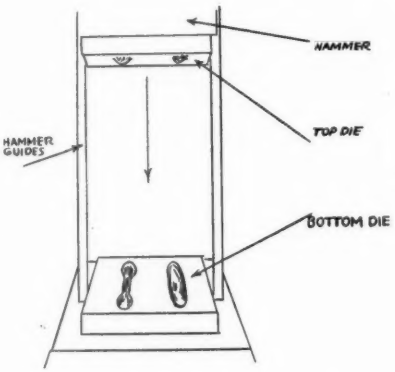
The operation may be performed on hot or cold stock. Pressure is applied steadily at a controlled speed. Dies may be lubricated. Special service requirements include the ability to take high polish and provide smooth unscored shell, and the strength and toughness to resist tearing action on drawing edges. Type GA or heat treated type GA to 450 Brinell has been found most suitable for dies of this kind.

Heat treatment may be omitted in cases where small run only is required. The cupping of Stainless Steel may require Meehanite in the "as cast" condition without heat treatment in order to provide the maximum lubrication properties to obviate scoring and seizing.

Drop stamping is stamping or forging a hot billet of considerable dimensions to shape.

Drop Stamping

The top die is attached to a heavy hammer as shown in Fig. 3, which is allowed to fall by gravity a regulated distance. A repeated number of blows are usual. The power used in this operation is usually considerably less than in true forging but the impact shock is much greater.



Special Service requirements are impact resistance on uneven plane and heat resistance.

Iron dies are not suitable for this severe service, heat treated alloy tool steels usually being employed.

However, if the weight and drop is not too great or if a very limited number of forgings are required, or even in the case of obtaining a first trial stamping, Meehanite dies cast in type "GM" to produce maximum toughness, may be successfully employed.

Embossing and Coining

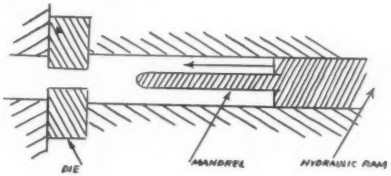
These operations normally employ tremendous pressures and dies must be suitable for fine filigree work to be cut in them. Alloy die stocks are usually necessary.

However, for embossing non-metallic

materials with a more coarse design, Meehanite may be utilized.

Extruding

Extruding is the operation of squeezing a large billet in the plastic state (just below melting point) through an aperture in order to produce a regular shaped bar, tube or rod. Pressure is supplied by a hydraulic ram shown in Fig. 4. Lubrication of the dies is impracticable. A spreader head or mandrel is used in tube forming.



For extruding operations, dies must provide high hardness to maintain size and withstand excessive abrasion and erosion. Type "GA" Meehanite Dies—heat treated or with flame hardened drawing edges—have been successful. Types "GB" and "GC" with chilled faces have also been used.

Mandrels require heat resistance, rigidity, abrasion and erosion resistance. Mandrels are usually hardened steel, although Type GA Meehanite with hard exterior and tough center might be applied in certain instances.

Forging

Forging is usually performed by means of power hammer or power press. Forging hammers are normally used to shape billets, bars, etc., which in addition to shaping also confer additional strength to material when worked down to correct temperature. All operate upon uneven sections. Impact shock is usually not so great on dies as with drop stamping.

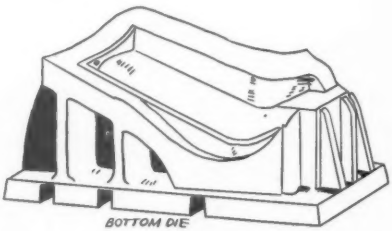
Forging dies must posses good impact resistance to unevenly distributed load; heat resistance; and high strength to resist heavy pressure. Such dies of type GM Meehanite, as cast, chilled, or heat treated may be used in some cases.

Steel dies are usually favored for this purpose. The pressures involved in the forging and uneven distribution of the pressure, which is normally applied as a blow, practically preclude the use of a cast material such as Meehanite. Meehanite dies are, however, used to a limited extent in forging machines where pressures are not excessive.

Forming

Forming is a shaping operation, with a limited amount of stretching or light drawing taking place. The operation is carried out on thin blanks which may be hot, though generally cold. Frequently pressings of considerable size are produced. The bottom die is shown in Fig. 5.

Pressure may be applied rapidly, though as the operation more nearly approaches drawing, a controlled steady speed of closing is applied. Dies may be lubricated.



For these operations die cast in types GM, GA and GB Meehanite are used extensively. Some of the smaller sizes have been heat treated where large output was essential. Process GC Meehanite has also been used for dies up to and over 4 tons in weight where shrinkage problems of highest strength types in relation to casting designs make a too difficult problem for the foundry.

Bending, Expanding, Flanging Horning, Raising, Rolling, Straightening, and Swaging

The above operations have been grouped together, since although they are not called upon to give identical service, they differ but slightly in use from the preceding examples. In other words the stock is not pressed to shape by or through the die, but the die is a shaped support onto which the stock is worked into shape.

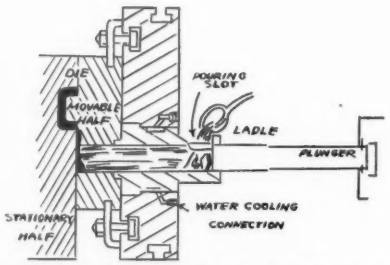
Die requirements are strength, rigidity, toughness, machinability, heat resistance (if hot working) and surface finish. High strength types of Meehanite (GM, GA, GB) are used for dies for these purposes, in many instances cast closely to form.

Die Casting

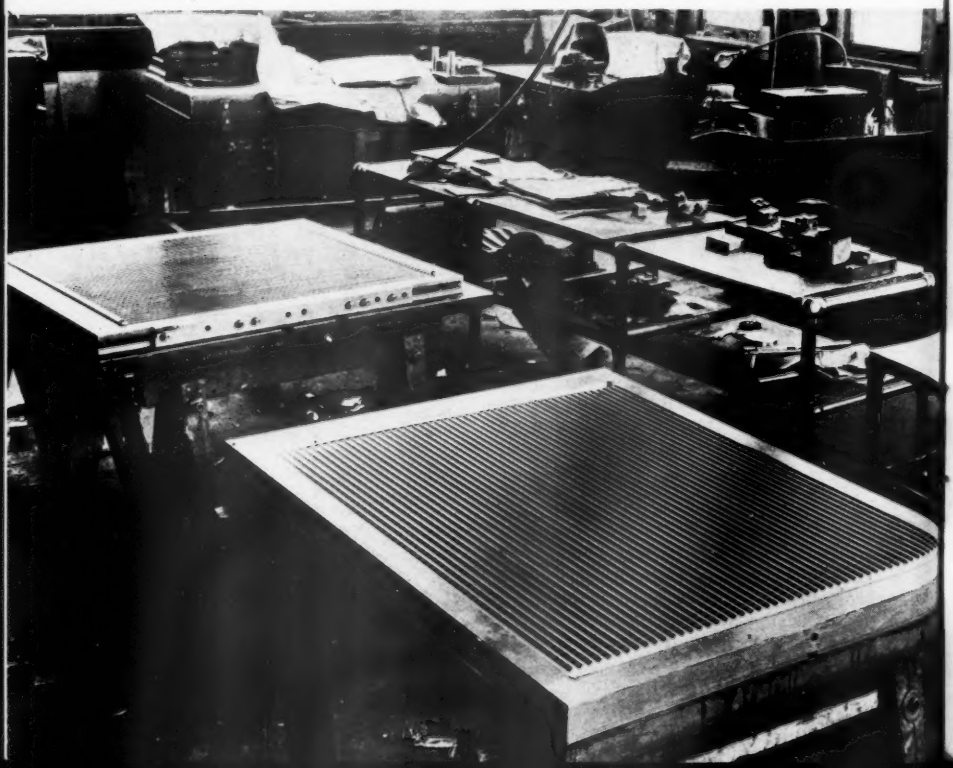
There are two process of die casting: the gravity die casting process and the pressure die casting process. Both processes are mainly applied to non-ferrous metals of low or medium melting point, particularly the zinc base and aluminum base alloys. The metals and alloys used for pressure casting necessarily have a very short freezing range. Gray iron is also successfully cast in permanent molds on semi-automatic machines such as the Holley Process (gravity). Here again there is a vast difference in the requirements of molds used in the two processes.

Gravity die-casting

In this process the operations of the ordinary foundry are quite closely followed. The mold shown in Fig. 6 is opened and closed by hand, cores inserted and extracted by hand, and the metal hand poured—the only real difference being that the cores and mold are permanent instead of sand. Accuracy of castings may be 0.005" per inch. For the best service, the die metal is required to have extremely fine grain, heat resistance with minimum checking, erosion resistance, and machinability.



Limiting factor is the temperature of metal so cast, i.e., dies for aluminum bronze (pouring temperature 2012° F), will have relatively short life.



Pressure Die Casting

The pressure Process is totally different, automatic operation throughout being aimed at the human element being reduced to a minimum. Split or many part molds being mounted on slides, which are operated and held in closed position by hydraulic power.

The fundamental difference, however, between the two processes so far as the mold is concerned is that the metal in a liquid or pasty condition is projected into the mold at a high velocity under a very high pressure—as high as 4,000 lbs. p.s.i. in the case of cold chamber machine, and about 400 lbs. p.s.i. when using the gooseneck machine. This pressure is air exerted onto the bath of metal in the case of the gooseneck machine but to a ladled shot of metal only in the case of the cold chamber machine.

The air pressure results in extreme accuracy of the product, which is usually within 0.001" and 0.002" per inch, and this accuracy calls for exceptionally fine grained and non-warping mold of free machinability, in addition to withstanding the effects of erosion. The dies may be water cooled. Service requirements include heat resistance (may be intermittent-temperature of 752° F may be attained by die), erosion resistance, resistance to solvent action of liquid metal under pressure, strength in tension and compression, and machinability-fine grain.

Plastic Molding

The molding of plastics is carried out by the application of heat and pressure —the heat bringing the formaldehyde, or resinous compounds which may be powdered or in small pieces to a plastic condition, and the press causing this to flow to the pattern of the mold. By this process Bakelite becomes "cured", i.e., it takes a permanent hard form of the mold. Most other plastics, on the other hand, retain their shape ony below a certain temperature, and as chemical reaction takes place other than resolidification—this frequently demands a cooling or chilling provision in the mold.

A considerable degree of accuracy is demanded and the molds are usually small and intricate, machinability and fine grain structure being essential. Heat is normally applied to the mold by contact and conduction from electrical resistance heater. Pressure varies according to design but is considerable in all cases. For service the mold metal must have absolutely fine grained surface, ability to take perfect polish, high tensile strength, high compression strength, easy machinability, toughness, abrasion resistance, and non-warping characteristics. Types GM and GA Meehanite are used for such non-metallic molds.

Molds For Rubber Products

This is a further operation where heat and pressure are required to form the article, steam heat being usual. Dies or molds may be of considerable size or very small—there is no limitation to the size as with Bakelite, and pressures are in" steam heating ways for heating. Service requirements include fine grain, easy machinability, abrasion resistance and heat resistance. These requirements are met by types GA and GB Meehanite.

Ceramic Dies

These are molds into which the clay mixture is pressed, prior to firing. Presses are quick operating and exert considerable pressure.

Service requirements are abrasion resistance, tensile strength and impact resistance. In making wall tiles a mixture of a large proportion of silica sand, bonded with clay, is used, which is very abrasive. The presses used are screw operated percussion presses which subject the dies to an extremely heavy impact.

Meehanite type GA meets all the requirements for a die for this material. One important factor is the porosity of the Meehanite.

In the manufacture of hollow building tiles, the extrusion dies are lined with sections of GA Meehanite, quenched in water. They are left dead hard and give a considerably long life.

This is no doubt due to the fact that the slight porosity of the Meehanite allows it to retain a small portion of oil which lubricated the dies as the clay is forced through them.

HUMAN ENGINEERING...

A NEW type of engineering is becoming very important in our war production program. It is identified with progressive management in the United States and is of the type which will carry over into peacetime industry.

By Rear Admiral
C. H. Woodward, USN

Electrical, chemical, mechanical, aeronautical, industrial, and civil engineering are established professions throughout the world. This new kind of engineering is Human Engineering.

Progressive American management is looking to practical psychology for ways and means of increasing production of war materials. Industry has realized that workers and their relationship with management need as much attention as the materials and machines with which they work.

Knowledge of human nature, ability to understand workers' problems as well as management's problems, and sympathetic respect for the rights and feelings of both labor and management, and for the rights of all mankind, are essential tools for the Human Engineer.

Since labor relations are a form of human relations, management may well utilize the appeals which may be made to draw the best out of every worker. Wages are important, and so are bonuses for especially good work. But, there are other appeals which may be utilized, such as appeals to a man's patriotism, his desire for recognition, his competitive spirit, his ambition for promotion, his loyalty, his sense of duty, his creative impulses, his appreciation of desirable surroundings, his confidence in his superiors, his desire for a good reputation, his desire for self-development, and his instinct for self-preservation.

The proper appeal to these motives can be just as effective as any money appeal, and American management is directing its efforts along these lines more and more with remarkable results. It must be remembered, however, that a living wage is always an essential. Where it is received, the worker will in most cases respond to these fundamental human appeals.

Foremen and foreladies can do more to cause increases in production of war materials than any other group in American industry. They form the link between management and workers. They are responsible for getting the work done in their respective departments, and done on time. If a company's foremen and foreladies have been intelligently selected for ability to lead, and if they have been properly trained, that company's morale and incentive problems are minor.

The worker who puts all of himself into his job contributes his ability, ideas, energy and cooperation as well as his labor to the task. He can be counted on to do more and better work than the employee who merely plugs along and makes drudgery of his job.

Many companies are wasting vitally needed manpower, by not fully utilizing the full capabilities of all their employees. There are few employees who could not and who would not do more and better work for their employer if their whole-hearted cooperation were obtained. Put every worker's brain-power back of his physical power, and production of war materials will increase considerably. Labor-management committees are doing much along this line to increase production.

Stimulating the interest of workers is the job of the Human Engineer. He surveys the situation in each department of the plant or shipyard, discovers the incentive problems and prescribes the appropriate remedies. If he is efficient, he can contribute as much to production as any other engineer of the more established professions.

...key to plant efficiency

By Bob Hamilton
Vice-president
The Dumore Co.

WITH the increased drive for production and the ever increasing shortage of skilled help, it is imperative for industry to make the most of every employee.

With this end in view, at Dumore we took an inventory of every key executive, salesman, foreman and lead man in our organization. We engaged the services of a trained Doctor of Psychology to come in and run scientifically prepared aptitude tests.

After our people had taken the tests, the tests were scored and compared to the established standards. One case that was referred back to the executive committee involved an employee that had been with our organization for over 18 years. The man is a high school graduate, 35 years old, married, with one child. He had been doing fairly successful work in his capacity as Cost Manager and Personnel Director.

However, in the tests he showed a definite inclination toward selling with a high score in dominance and self-efficiency. His intelligence scores from other tests showed him to be fairly intelligent, but his cooperative score and his emotional stability score were lower than the average. His outstanding interests were in sales and business. There was little interest in accounting and less in personal work.

The psychologist suggested placing the man in sales work. As a Personnel Director he had done his best work in selling life and hospitalization insurance.

When we asked him if he would like a change over to selling, he was really overjoyed. He told us that for the first time in his life he felt that he was going to get into something in which he really could be successful. He now gives every indication of being one of our best salesmen.

Incidentally, it was through these aptitude tests that we found our new Personnel Director. An inspector out in the shop who took the test scored very well and is working out excellently.

Of course you can't change every employee over into a new job without disrupting an organization. Sometimes when a man scores poorly, it is still necessary to keep him in his present work.

Such a case in our organization illustrates what can be done. One young man, a high school graduate, scored as well as the upper 10% of the college graduates who took the test. Because of his limited education, this boy developed a bad inferiority complex which showed up in the score. All other scores of intelligence, selling, dominance, cooperativeness and unselfishness were above average. Only the scores of self-confidence and emotional stability were below.

Criticism which normally did not affect the average worker would weigh heavily on this boy and so we were extremely careful to encourage him and to be tactful in correcting his mistakes. We watched the amount of work given him and you might say that we are practically hand-feeding him in order to build up his confidence.

Some time has gone by and a recent check showed considerable improvement. Errors formerly noticed in his work have begun to disappear, his correspondence sparkles, and there is every indication that improvements are beginning to come.

The aptitude tests are not the cure-all in themselves and never will replace personal judgment. They merely define what you have to work with.

In many cases the tests confirm that which you already know. But even then it is helpful in backing up personal judgment and eliminating the danger of prejudice.

Dayton Rogers

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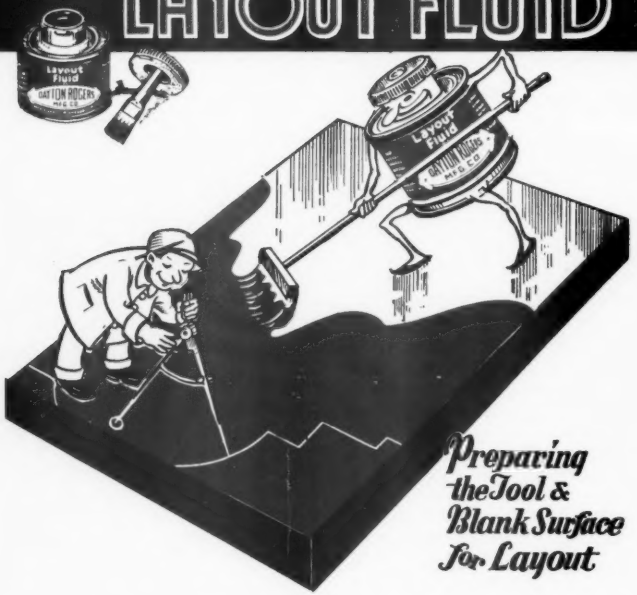

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TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES

BROACHING TECHNIQUE

Part 1

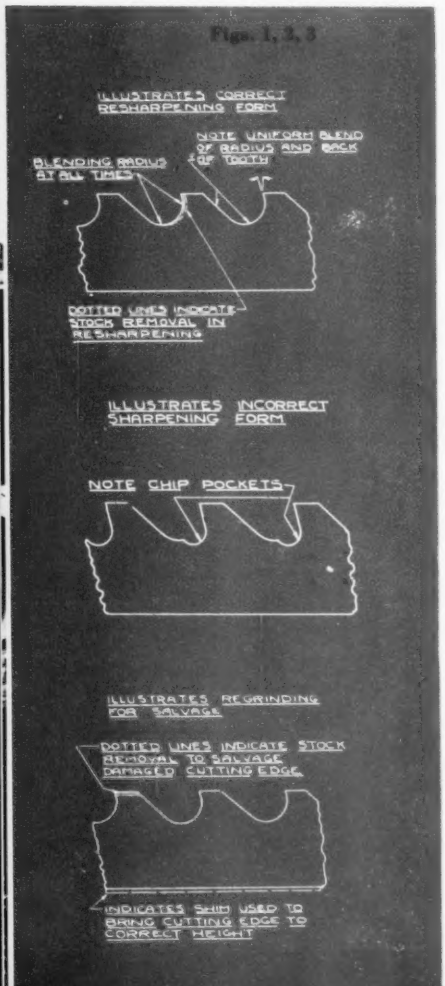
CLASSES of work formerly considered practical for milling only are being broached to greater accuracy at an increased rate of production. Other advantages are good finish and interchangeability of work.

Broaching consists of machining surfaces by drawing or pushing entirely past the surface a broach or several broaches having a series of teeth which progressively increase in size or height. Each tooth takes a light cut and, by a succession of cuts, a surface is speedily and accurately formed that is a reproduction of the shape of the final cutting edges of the broach. Originally, broach-

ing was restricted to internal work, but now many flat or external surfaces are machined by this process.

Broach Design

The following factors must be considered in determining broach design: hardness or toughness of material to be broached; kind of steel used for the broach and its heat treatment; stock removal; length of surface to be broached; type of hole; accuracy and finish desired. Type of machine to be used, depth of cut per tooth, pitch or spacing of teeth, and shape of teeth are also important.


ILLUSTRATES CORRECT RESHARPENING FORM
NOTE UNIFORM BLEND OF RADIUS AND BACK OF TOOTH
BLENDING RADIUS AT ALL TIMES
DOTTED LINES INDICATE STOCK REMOVAL IN RESHARPENING
ILLUSTRATES INCORRECT SHARPENING FORM
NOTE CHIP POCKETS
ILLUSTRATES REGRINDING FOR SALVAGE
DOTTED LINES INDICATE STOCK REMOVAL TO SALVAGE DAMAGED CUTTING EDGE
INDICATES SHIM USED TO BRING CUTTING EDGE TO CORRECT HEIGHT
Figs. 1, 2, 3

Since the cutting or roughing teeth are usually followed by several finishing teeth, which take extremely light cuts, broaches ordinarily will accurately finish a large amount of parts before sharpening is required.

The main tooth elements of a broach include: pitch of teeth; rise per tooth; rake angle; relief angle; and chip space. The pitch of teeth (distance from one tooth to the next), depends upon tooth strength, length of cut, shape and size of chips. Roughing teeth pitch should be very coarse to provide ample chip clearance. At least two teeth should be in contact with the work at all times.

Tooth pitch must be large enough to provide room for the chips formed during one stroke; but unnecessary pitch or spacing will unduly increase the length of the broach and, consequently the length of the working stroke and the broaching time. The relation between the length of the broached part and the pitch should be such that from three to six teeth will be cutting at the same time. In broaching very thin parts, several may be held in a stack, thus increasing the total length so that it spans two or more teeth.

A rake angle of 5° to 15° for general work is given the front faces of teeth. This reduces power consumption and produces smoother surfaces. Angles up to 15° are satisfactory for ductile metals. Smaller angles are used on cast iron, brass and bronze.

Relief angles of broach teeth vary from 1° to 3°. The tapered cutting teeth have a relief. Teeth with no rise often have a land with no relief. This assures retention of size after sharpening by repeated grindings on the fact of the tooth.

Types of Broaches

A broach may be classified as pull, push or stationary; internal or external; single purpose or combination; roughing, sizing or burnishing. Push broaches, usually shorter than pull broaches, are employed where only a small amount of metal is to be removed. Pull broaches

are usually long and have many teeth. They are used to remove a considerable quantity of metal and ordinarily to finish a surface with one pass.

Push broaching for internal work is often used on parts where a small amount of metal is being removed from the hole and where a good finish with close limits is desired. It can be used in sizing holes in gears to remove distortion caused by heat treating as well as for small parts having splines, square, hexagonal and other irregularly shaped openings. See Fig. 4.

Internal Broaching

Internal broaches are of either the push or pull types of keways, splines, round, square or hexagon shaped holes; large or small for internal gears, odd shapes and forms.

The set of three broaches in Fig. 9 produced the finished hole with the integral key in the bronze part shown. The finish extended the full length of the 9" long piece, with no reliefs cored. Fig. 12 shows the broach used in producing the small cam illustrated full size in Fig. 9. Six work pieces were finished in one pass of the broach. Broach produced an eccentric cam starting from a plain round hole concentric with the finish outside diameter.

Fig. 7 shows an unusual broaching application. The crescent shown as the finished piece at the right serves as a bearing for an internal running gear in a popular hydraulic pump. The pull broach starts from the round hole at the left, and from this hole the teeth spread out in the cut forming the irregular shaped hole. Four pieces held in a simple fixture are broached at one pass.

Fig. 4

Figure 10 illustrates a setup for cutting keyways. The broach puller is shown assembled in the sliding head of a horizontal broaching machine.

External Broaching

External or surface broaching is utilized on many kinds of plain and irregular surfaces, permitting greater accuracy and closer limits. This results in the production of parts which are interchangeable and easy for assembly. The cost per piece is greatly reduced in comparison to other methods.

Surface broaches, with the combined cutting quality of a roughing and finishing tool, are made to accommodate many irregularly shaped and formed

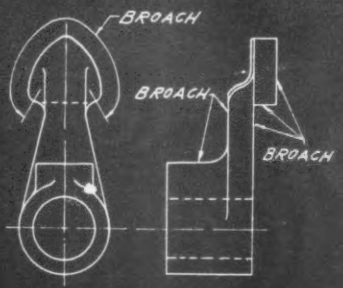


Fig. 5

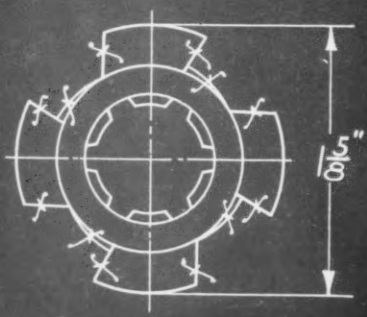


Fig. 6

Fig. 7

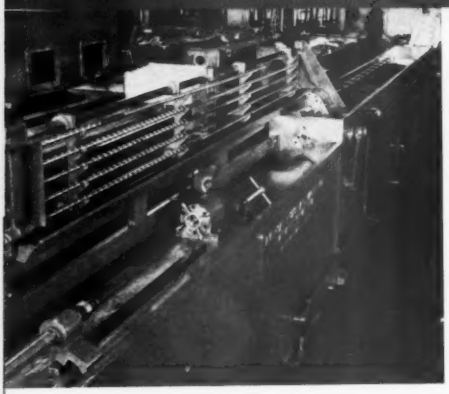


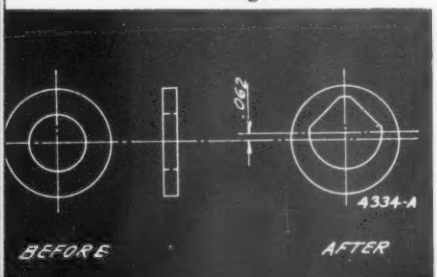
Fig. 8

cuts that cannot be machined by other methods. These broaches, are usually made in sections. The roughing section of the broach removes the major portion of metal. From this section the teeth are evenly graduated for rise up to the finishing teeth.

A cam broaching application that is saving its user considerable in time and tooling costs is illustrated in Fig. 5. The complete heartshape is produced in one pass with a broach assembly. Cams generally require smooth surfaces. This can be insured by broaching.

Workpiece (Fig. 6) has 12 finished surfaces which are all broached at one pass, removing $\frac{1}{16}$" metal. Operation is performed on an American dual ram hydraulic press with tooling to provide high production with safe and easy handling facilities.

Fig. 9



Combination Broaching

Combination broaches are designed to permit two types of cuts such as size and burnish a hole or size the hole and broach internal gears or splines in one pass of the broach.

Multiple Broaching

Multiple broaching is often applied to smaller classes of work. In some cases, two or more parts are so shaped that they can readily be placed in stack formation for broaching. Another method consists in using two or more parallel broaches, so that an equal number of parts are broached simultaneously.

Spline Broaches

Spline broaches are made in both push and pull types. Either type can be made combination or plain. The combination broach finishes the hole to size before cutting the splines. The plain broach cuts the splines only. Figure 14 shows the end view of a spline broach. The spline width and outside diameter are shown to the finish dimensions of the work part, while the root diameter of the broach serves as a guide and is a few thousandths less than the finished round hole.

Figure 11 shows one of the splines enlarged. The corner is made either sharp with a radius or chamfered. The radius or chamfer in the finished holes serves as clearance for the radius on the mating shaft.

Figure 13 shows the side relief provided on broaches having splines exceeding .100" in depth. This relief prevents seizing and insures smooth cutting. After the broach teeth have produced the radius or chamfer shown in Fig. 11, the remaining teeth are undercut as shown in Fig. 13.

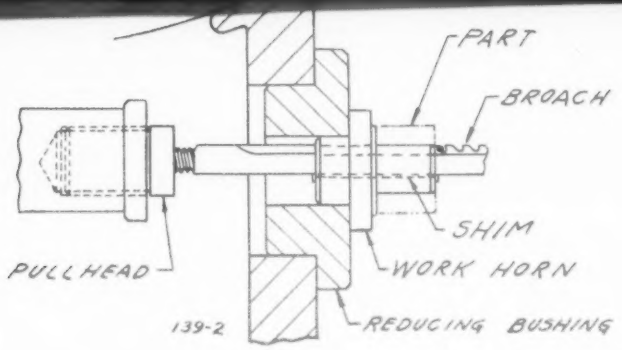


Fig. 10

Figure 13 shows the side relief as applied to gear tooth broaches. All tapering teeth in a gear broach have the upper portion of the spline ground to true involute form.

In addition to correctly designing a broach for its specific purpose, success in broach use involves a number of factors and when one or more of these factors is overlooked broach life is shortened, production is lower than anticipated, finish dimensions and accuracy are impaired.

Correct Broaching Simple

The very simplicity of the broaching operation sometimes causes difficulty. The part is quickly mounted in a simple fixture or one that is easily operated. The pass is rapidly made. After the stroke is completed, the work is removed and the broach returned to initial position. Since a broach, when correctly used, will produce a hole of maximum accuracy and straightness, broached holes are ideal for use in locating parts for machining. The soundest practice is to broach first and then machine the OD faces, etc., locating from the broached hole. This should apply equally to finishing and roughing operations.

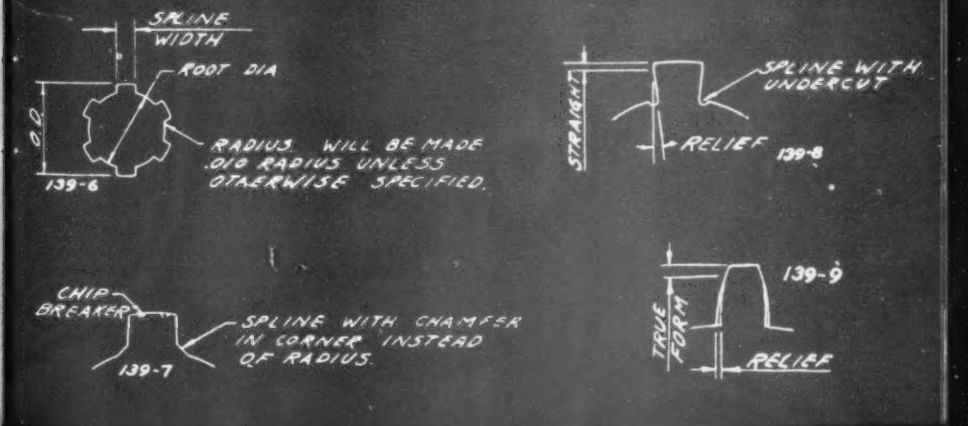
Proper Broach Handling

This important part of broach use includes the correct handling and storing of broaches in the shop. Broaches should be properly supported against breakage from shock, such as may occur if the shipping box is accidentally dropped or roughly handled. The teeth of a broach should never come in abrupt contact with any hard material since the slightest nicking of a tooth reduces the efficiency of the unit.

Broach Sharpening

Not only will broach life be prolonged

Fig. 11



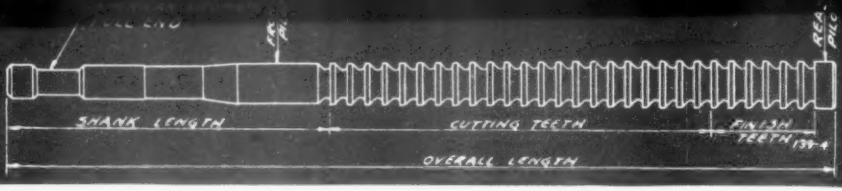


Fig. 12

by correct sharpening, but quantity of parts produced and their conformance to specified dimensions and finish may be impaired unless this operation is performed properly. The sharpening equipment should be designed specifically for this operation. A point to remember is that only enough metal should be ground from the face of a tooth to bring that particular tooth to desired sharpness. It is also important that the correct type of grinding wheel be used. The wheel size, grain and grade all have a bearing upon the speed of sharpening, prevention of burning, glazing of the wheel, etc.

A smooth surface finish on the broach teeth permits the chip to move freely along the surface of the entire tooth form and will create a "natural" rounded chip, allowing maximum chip space between the teeth.

Figure 1 illustrates the proper sharpening method. Notice the correct form and contour of the teeth maintained by this procedure. This form permits the chip to curl and clear itself from the edge of the tooth that is in cutting position and indicates the effect of successive sharpenings. Figure 2 shows the improper method of sharpening. The tooth contour has not been maintained. The edge of the grinding wheel has produced a groove below the proper curvature of the tooth form, thus creating a pocket which will prevent the chip from clearing the point of the tooth. Chips will load in the pocket, decreasing the distance normally available for chip clearance, which may cause the broach to break.

On surface broaches designed for use in a broach holder the teeth can be reconditioned by restepping and rebacking off on top of the tooth form, as shown in Fig. 3. This operation requires extreme care, since the proper stepping, backing off and tooth depth must be maintained.

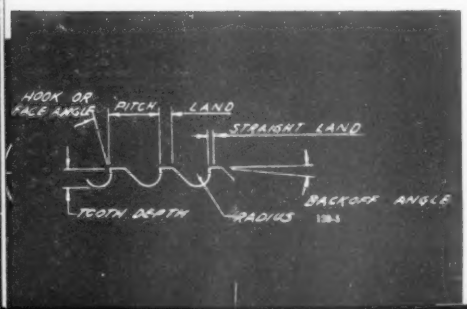
Should a broach become stuck in the work due to inadequate machine capacity, excessive broach dullness, lack of sufficient power or complete failure of the power supply, removal of the work from the broach becomes an operation requiring special care, if damage to the broach is to be avoided. Under no circumstances attempt to reverse the broach out of the work or tooth breakage is almost certain to occur. The proper procedure is to utilize one of the methods given on the "Do's and Don'ts" pages of this section.

Common Broach Terms

Figures 11 and 13 illustrates the terms usually applied to broaches. In Fig. 18, the term CUTTING TEETH is sometimes referred to as the taper section of a broach. Fig. 19 illustrates a side view of the teeth in any type of broach.

HOOK ANGLE varies with the material to be cut from 0° to 15°. PITCH is a function of the length of cut determined by the thickness of the chip removed per tooth. LAND should be of sufficient length to withstand the cutting strain. STRAIGHT LAND is generally used at the finishing end, the purpose of which is to retain broach size. BACK-OFF ANGLE, provided as clearance for the work, is held to a minimum to prevent excessive wear. RADIUS is provided for tooth strength and to induce the chip to coil when broaching ductile metals. TOOTH DEPTH is proportional to the pitch and is made sufficient to accommodate the chip removed.

Fig. 13



DO'S AND DON'TS ON BROACHING

DO check the suitability of a broach for a specific job. Material, length of broached hole, broaching speed, broaching fixture and type of broaching machine all affect satisfactory broach performance.

DON'T permit the cutting teeth of a broach to come into contact with a hard metal edge or surface since the cutting teeth of broaches are generally extremely hard and may be damaged.

GRIND only enough metal from *each tooth* of a broach to bring it to required sharpness. Grinding away more than the necessary amount shortens broach life.

USE adequate sharpening equipment, designed especially for broaches. Broach life is materially shortened if correct tooth form is not maintained and the broach is not held properly in the sharpening machine.

USE the right type of grinding wheel when sharpening broaches. The wheel size, grain and grade are important in obtaining sharp cutting edges without burning the metal.

BEFORE deciding on any broaching set-up, make sure that the broaching machine is of adequate capacity for the specific job to be performed. Broaching speed and smoothness of operation affect broaching time, and quality of the work.

IN making any broaching setup, check the alignment of the puller and guide bars (if used) with the centerline of the face-plate or platen before mounting the fixture.

IN hole, spline and keyway broaching operations, check the alignment of the fixture with the centerline of the broach, puller and guides before starting operations.

IN helical spline broaching, keep backlash and wear of the broach drive head and lead bar at a minimum. It is difficult to maintain close limits on helix angles, if excessive wear exists.

IN all surface broaching operations, make sure that the fixture is sufficiently rigid to prevent movement of the piece.

SHOULD the piece become stuck in internal or hole broaching, remove the piece from the broach by one of the following methods, after first carefully *removing both stuck piece and the broach from the machine:*

1. Gently tap the piece evenly and slide it off the starting end of the broach. If the piece cannot easily be removed by this method, then
2. Place the stuck piece and broach in a lathe and turn the piece from the broach, or
3. The piece may be sawed in two with a hack saw and thus freed of the broach.
4. A combination of methods 2 and 3 may sometimes reduce the time required to free the piece from the broach.

IN surface broaching, if the broach becomes stuck before the pass is completed, proceed as follows:

1. Loosen the piece in the fixture by unclamping it, if a non-retracting table or fixture is used. Then loosen the fixture and withdraw it from the broach.
2. If the broaching machine has a receding table, carefully retract the broach table. Only the lightest force should be used while doing this.
3. Check the broach, fixture and table to make sure that no broken parts of the piece will catch between the fixture and broach when the broach is returned to starting position.

DO'S AND DON'TS ON BROACHING

BEFORE starting the broach pass, make sure that the piece is firmly and fully seated in the fixture. Slippage or "jumping" of the piece during the pass may break the teeth.

ALWAYS complete the broach pass and remove the piece before reversing the machine and returning the broach to initial position.

WHEN broaching from a cored hole in a casting or a forged hole it is preferable to use an equalizing fixture to avoid excessive eccentricity to the load on the broach.

DESIGN the holding clamps which retain the piece in the fixture so that the piece cannot slip during the the broaching operation, even if an unusually heavy load is encountered, such as one due to additional metal in a forging or casting, a hard spot, etc.

MAKE sure when broaching from drilled holes, that the hole is square with the face of the piece which contacts the fixture.

DESIGN all indexing mechanisms so that no backlash can occur while a piece is being broached.

IF a broach becomes stuck in the work (due to failure of power supply, etc.) never reverse the machine or try to push the broach out backwards (against its normal cutting direction). Tooth breakage is almost certain to occur if this is done while the broach is in the machine.

DON'T expect a broach to correct excessive eccentricity due to inaccurate previous machining. It is best practice to use the broached hole as the "locating point" for subsequent OD turning or facing operations where close concentricity must be obtained.

ALWAYS transport broaches carefully to avoid striking the teeth against any metal surface. Preferably transport and store them in specially designed tote boxes or bins fitted with wood or other soft materials where contact with the broaches takes place.

We are indebted to American Broach & Machine Co. and Colonial Broach Co., among others, for textual data and illustrations.

REPRINTS AVAILABLE

The nine articles thus far published are:

Broaching Technique	***Turning Technique**	**Planer & Shaper Technique**
***Grinding Technique**	**Drilling Technique**	**Threading Technique**
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They have been reprinted to meet the tremendous demand from war production, training classes, department heads, government officials and machine operators. When ordering reprints, please designate the number of copies of each article desired. Address request to Reprint Division, The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland, O.

**Supply of reprints exhausted.*

FUNDAMENTALS IN THE USE OF DIES FOR PRESS BRAKES

By A. G. Baumgardner

A PRESS brake is not complete without dies. The two make a team in production. The problem of the proper die is constantly recurring and many times calls for the best technical skill and accumulated experience to be obtained. There are certain fundamental principles that will help you use your press brake to the best advantage.

"Air Bend" Dies

Figure 1 shows an 85° male and an 85° vee die. These are called "air bend" dies because they do not strike solidly on the metal. The metal being formed contacts only at the point of the male die and the two edges of the vee opening. Thus, all of the pressure is used in forming the metal and none in squeezing it. Dies of this type are primarily used for forming the heavier gages of metal.

The minimum flange that can be formed on any die opening is approximately one-half the die opening, plus two times the thickness of the metal. If a smaller inside radius or a smaller flange is desired, a smaller vee die opening must be used. This increases the pressure required to make the bend. The accompanying chart gives the tons required per linear foot to bend mild steel with "air bend" dies. For example: 65 tons are required to bend a piece of 12-gage metal 10' long with dies illustrated in Fig. 1.

This chart is the result of a great many tests and gives average values for mild steel having a tensile strength of 55,000 to 65,000 lbs. psi.

The bending pressure varies directly with the tensile strength regardless of whether the material is a straight carbon steel, a high tensile alloy steel, or a stainless steel. For example: for any material having a tensile strength of approximately 90,000 lbs. psi, the figures in the chart should be increased 50 percent.

"Bottoming" Dies

When forming parts for metal furniture, partitions, cabinets, or similar articles, bends with a high degree of accuracy and relatively sharp inside corners are desired. To obtain these results and minimize inaccuracies due to variations in the sheet thickness, "bottoming" dies (dies that strike solidly on the metal) must be used.

Many operators use a 90° male die with a sharp point and a vee die with an opening only five times the thickness of the metal as illustrated in Fig. 2. If these dies are struck together exactly as shown, on a piece of 12-gage steel 10' long, the pressure required, as obtained from the pressure chart, is approximately 131 tons. The smaller die opening of Fig. 2 has increased the pressure over that required for the dies in Fig. 1.

Now, if the dies of Fig. 2 are struck harder, as in Fig. 3, the metal overbends and contacts the vee die deep in the opening, raising the pressure to 262 tons. In other words, it has the same effect as using a considerably smaller vee die opening. By striking still harder, Fig. 4, the metal is forced into more complete contact with the dies, raising the pressure to 500 tons or more

for merely bending a piece of 12-gage mild steel, 10′ long. Note that the sharp point of the male die will not produce an absolutely sharp corner unless still greater pressure is applied, because of the natural excess of metal at the inside radius and at the very point of the die. A male die should be made with a slight radius to allow for this natural excess or crowding of the metal. Figure 5 shows the same bend can be made with only 300 tons pressure.

To further reduce the pressure, the vee die opening can be made with an angle of 88°. To reduce the pressure still more, the opening of the vee die can be increased to eight times the thickness of the metal, as shown in Fig. 6. These dies require a pressure of only about 100 tons. We might call these dies a combination of "air bend" and "bottoming" dies. They can be struck solidly together with minimum displacement of the metal being formed and, therefore, make an exceptionally accurate bend with the least pressure.

The choice of "bottoming" dies depends on the sharpness of the inside radius required and the capacity of the machine available.

How Not To Make "Bottoming" Dies

In Figs. 2 to 6, it will be noticed that the actual working nose of the male die is about the same as the width of the vee die. Thus, when the dies strike solidly together as in Fig. 5, there is no distortion of the bend. Figure 7 shows what happens when the working nose of the male die is too wide. In Fig. 8 the male die is too narrow. In Fig. 9 the vee die opening is too wide for the metal thickness.

Many operators have the mistaken impression that the pressure on a "bottoming bend" can be reduced by going to a larger vee die opening. A larger vee die opening will reduce the pressure on "air bends" but not on "bottoming bends." With "bottoming" dies having a large vee opening, the metal first forms with a large radius, which must be ironed out when the dies strike solidly on the metal. Too often the result is as shown in Fig. 9 because the press brake does not have sufficient capacity to completely iron out the resulting loops. The dies illustrated in Fig. 5 will give far better results.

All press brake forming work is based on the foregoing fundamentals. These principles apply to obtuse angle bends, acute angle bends, and even channel bends.

When offset or Z bend dies, as shown in Fig. 10 and Fig. 11, are made on the principles of "air bend" dies, the pressure required may be only two and one-half or three times that needed for a single right angle "air bend." If, however, they are made like sharp cornered "bottoming" dies, the pressure may be from five to twenty times as great. When making multiple bends each individual bend should be analyzed separately for forming action and pressure. By adding together the estimated pressures for the various bends and making some allowance for the wire drawing effect on a multiple bend, a good approximation of the pressure required can often be made. Occasionally, the bend is so complicated that the only way to determine the pressure is to make an experimental die several inches long, and test it with a testing machine or a hydraulic cylinder.

Radius Bends

When making a radius die, tests must usually be made to determine the amount of springback of the metal. No rules for springback have been worked out because there are too many variables. The springback depends on the thickness and hardness of the metal, as well as the size of the radius. Changing any one of these changes the result.

Radius Dies

The simplest and most satisfactory way to make a right angle bend with comparatively large radius is with dies similar to those in Fig. 12. Practically all metals spring back a certain amount when formed. Therefore, the radius on the top die must be made somewhat smaller than the radius desired, and the bottom die must have an included angle of less than 90°. These factors can be

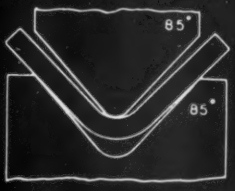


Fig. No. 1

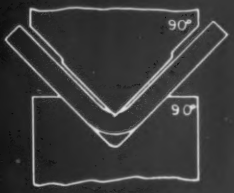


Fig. No. 2

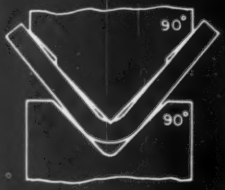


Fig. No. 3

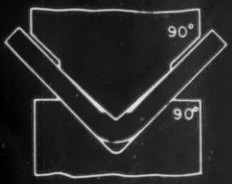


Fig. No. 4

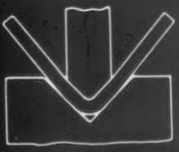


Fig. No. 8

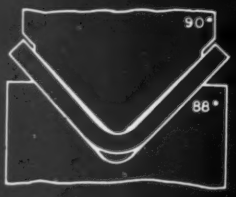


Fig. No. 6

Fig. No. 7

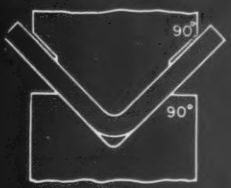


Fig. No. 5

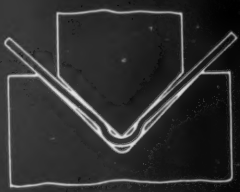
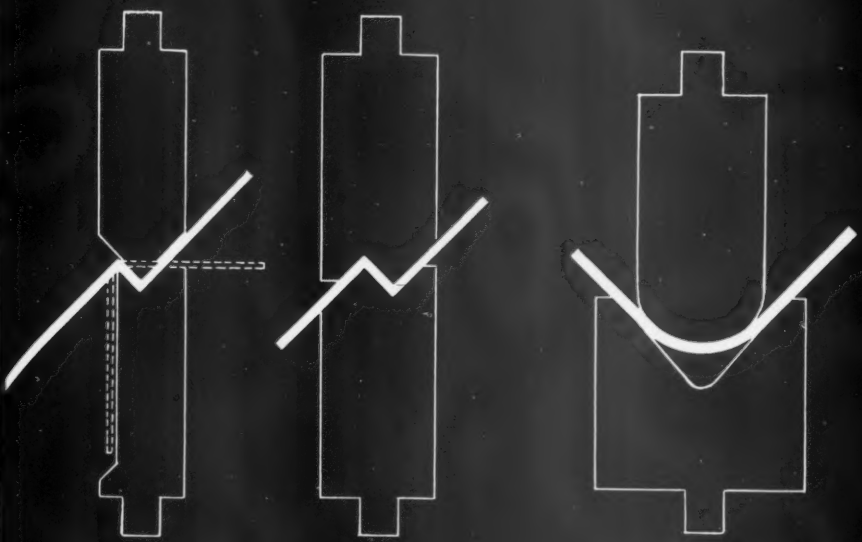


Fig. No. 9



determined only by actual experiment on the metal which is to be used.

To Make Uniform Bends

To make uniform bends, several "rules of operation" must be observed: Keep your dies in good shape; be sure bed and ram are parallel; adjust filler block so dies line up; work near center of machine; use prime or first quality sheets; don't use dies with unbalanced loading; don't overload your machine.

Blank Width Calculation

Many methods have been published for arriving at the amount of metal required for shapes having 90° bends. All are experimental and widths depend on accuracy of gage, hardness, direction of grain and speed of forming. For accurate work, check by actual tryout.

For the usual press brake work where the inside radius on the work approximately equals the thickness of the metal, that is R = T, for shapes shown in Fig. 13 the developed width can be found as follows: for angles, blank with = $L_1 + L_2$; for channels, blank width = $W + F_1 + F_2$; for offset or Z bends, blank width = $W + F_1 + F_2$.

Note that all dimensions are to the *inside*. The great majority of vee die work will fall in the foregoing classes. To lay out bend lines, the bends are marked on the inside of the work using inside dimensions of work as shown in Fig. 13.

Radius *Not Equal* To Metal Thickness

If the inside radii vary from almost zero up to three times the thickness of metal, use the following method. The dimensions are to the *outside* in this method because most sections including multiple bends are so dimensioned. This is illustrated in Fig. 14; blank width = $(W + F_1 + F_2) - (3\frac{1}{2}\ T + R/2)$.

To use this formula on multiple bends, add all *outside* dimensions around the piece and deduct $(3\frac{1}{2}\ T + R/2)$ for each *two* bends involved. For example, take $\frac{1}{16}$" stock. Adding the outside dimensions around the section, beginning at the upper left-hand corner:

First section	0.500"
Second section	2.000"
Third section	1.563"
Fourth section	0.563"
Fifth section	0.875"
Sixth section	2.500"
Seventh section	0.500"
Total	8.501"
Deduct six bends, $3(3\frac{1}{2}\ T + R/2)$	.750"
Blank width	7.751"

When the radii are over three times the thickness of metal, calculate the width of blank on the centerline of the metal (neutral axis) as very little stretching occurs.

Punching

In order to obtain the best life from a press brake, the punching load should be about two-thirds or three-fourths of the forming capacity. A convenient chart gives "Tons Pressure Required to Punch Mild Steel Plate".

To obtain the total pressure required for one-level punching, multiply the pressure shown in the chart by the number of holes to be punched.

The resultant tonnage should not exceed approximately two-thirds the rated capacity of the brake for smooth operation.

If punches are stepped one-half of the metal thickness or more, the total pressure will be reduced as follows: punches on two levels, divide by 2; punches on three levels, divide by 3; punches on four levels, divide by 4.

For best results on mild steel, clearance between the punch and die at all points should be from 5% to 7% of the thickness of the metal. In other words, the die should be 10% to 14% larger than the punch. For hard steels or stainless steels, the clearance need be only 3% or 4%.

Precaution

Always set up dies with the treadle locked and the eccentrics at the bottom of the stroke. Use the motorized ram adjustment for different die heights. From this point, the ram can only move up if the clutch is accidentally engaged,

thereby eliminating the major cause of jamming the dies.

When using "air bend" dies stay within the capacity of your machine. Remember that reducing the die opening increases the pressure required, and may call for a larger machine. Stainless and alloy steels require greater pressure than mild steel in direct proportion to the tensile strength. Accordingly, confine your stainless steel forming to thinner material.

When using "bottoming" dies, be sure they are designed so that the capacity of the press brake is not exceeded. If your machine is equipped with a tonnage indicator, it will tell you at what tonnage you are using the machine and whether you are overloading it.

Keep your press brake lubricated and be sure the clutch and brake are properly adjusted.

TONS PRESSURE REQUIRED TO PUNCH MILD STEEL PLATE

Shearing Strength of 50,000 Lbs. per Square Inch

Thickness of Metal		Hole Diameter																
Gauge	Inches	1/8"	5/32"	3/16"	7/32"	1/4"	9/32"	5/16"	11/32"	3/8"	13/32"	7/16"	15/32"	1/2"	9/16"	5/8"	11/16"	3/4"
20	.036	.35	.53	.71	.88	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.8		
18	.048	.47	.71	.94	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.8	3.1	3.3	3.5	3.8		
16	.060	.59	.89	1.2	1.5	1.8	2.1	2.4	2.7	2.9	3.2	3.5	3.8	4.1	4.4	4.7		
14	.075	.74	1.1	1.5	1.9	2.2	2.6	2.9	3.3	3.7	4.1	4.4	4.8	5.2	5.5	5.9		
12	.105	1.0	1.6	2.1	2.6	3.1	3.6	4.1	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.3		
11	.120	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.8	9.4		
10	.135	...	2.0	2.7	3.3	4.0	4.6	5.3	6.0	6.6	7.3	8.0	8.6	9.3	10.0	10.6		
3/16"	.187	.....	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8		
1/4"	.250	.....	.....	4.9	6.2	7.4	8.6	9.8	11.0	12.3	13.5	14.8	16.0	17.2	18.5	19.7		
5/16"	.375	.....	.....	.....	.....	11.1	13.0	14.8	16.6	18.5	20.3	22.1	24.0	25.8	27.7	29.5		
1/2"	.500	.....	.....	.....	.....	.....	17.2	19.7	22.1	24.6	27.1	29.5	32.0	34.4	36.9	39.4		
5/8"	.625	.....	.....	.....	.....	.....	.....	.....	.....	30.8	33.8	36.9	40.0	43.0	46.1	49.2		
3/4"	.750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.3	48.0	51.7	55.4	59.0		

TONS PRESSURE REQUIRED PER LINEAR FOOT TO BEND MILD STEEL WITH "AIR BEND" DIES

Thickness of Metal		Width of Vee Die Opening																						
Gauge	Inches	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"	7"	8"	10"	12"
20	0.036	3.1	2.3	1.7	1.4	1.1																			
18	0.048	5.3	4.0	3.0	2.5	2.2	1.7	1.3																	
16	0.060	9.6	7.1	5.6	4.5	3.8	2.8	2.2	1.8	1.5															
14	0.075	...	11.9	9.2	7.6	6.3	4.7	3.5	3.0	2.5	2.1	1.8													
12	0.105				16.7	13.1	9.7	8.0	6.5	5.6	4.6	4.1	3.2												
11	0.120					19.2	14.2	11.1	9.0	7.5	6.3	5.5	4.4	2.9											
10	0.135						18.6	14.5	11.9	9.9	8.5	7.3	5.8	4.0											
3/16	0.188							27.4	23.1	19.3	16.4	14.3	11.2	7.5	5.7	4.4									
1/4	0.250									39.4	33.3	29.5	22.7	15.4	11.4	9.0	7.4	6.1							
5/16	0.313											50.4	39.8	27.0	19.7	15.3	12.7	10.5	7.7						
3/8	0.375												61.6	42.3	30.9	24.0	19.6	16.3	12.3	9.5					
7/16	0.438													61.7	45.8	35.4	28.6	24.4	17.3	14.8	11.2				
1/2	0.500													85.2	63.6	48.8	39.7	33.3	24.6	19.4	15.9	13.1			
5/8	0.625														110.0	86.2	70.0	58.3	43.1	33.3	27.4	23.3	16.9		
3/4	0.750															138.0	110.0	93.0	68.7	53.5	43.6	36.5	27.1	21.0	
7/8	0.875																165.0	137.0	104.0	80.7	64.6	52.9	39.7	31.6	
1	1.000																	197.0	143.0	113.0	91.2	76.2	56.3	44.2	

The tonnages underlined are for Vee Die openings eight times the thickness of the metal. These generally are used for average right angle bending work, as they give an inside radius of the bend approximately equal to the thickness of the metal.

ABSENTEEISM...

A SYMPTON NOT A DISEASE

In an effort to find some down-to-earth answers to the problem of industrial absenteeism, more than 200 outstanding American war plants recently pooled their absenteeism experience with the Division of Labor Standards, United States Department of Labor.* Recognizing that effective remedies must be specifically geared to causes, they have indicated the methods of control tried at the plant level, and the degree of success which might be expected from them.

One of the most serious causes of absenteeism which the machine tool industry has met among its skilled designers, tool-setters and die-sinkers is that resulting from long hours of work. Although toolmakers in the main thoroughly understand the importance of their work, their comes a time when fatigue overcomes even the valiant spirit of patriotism.

Many tool manufacturers, thoroughly aware of this problem, constantly try to reduce hours by simplifying processes and training new workers to assist the technician in many of his less complicated tasks.

Management testimony indicates the wisdom, moreover, of following the recommendations on hours of work for maximum production issued in July 1942 by a committee representing the War, Navy, Commerce and Labor Departments, War Production Board, War Manpower Commission, Public Health Service and Maritime Commission.

Whatever the causes of absenteeism—and they are many—"the most effective controls have to come from within the plant by management, with the cooperation of labor," said R. Randall Irwin, Lockheed-Vega Corp., Burbank, Calif., at absenteeism hearings before the Labor Committee, House of Representatives, March, 1943.

*Details of the survey may be secured by applying to the Division of Labor Standards, U. S. Department of Labor, Washington, D. C., for "Controlling Absenteeism—A Record of War Plant Experience."

Penalties or monetary rewards have not generally proved efficient in a short labor market. Recognition of steady performance, however, by such awards as special insignia and short vacations has increased cooperation and morale.

Absence control should be made a part of foremen meetings and training programs. Shop stewards, labor-management committees, and union officials can help to reduce absenteeism by interviewing repeaters and conducting attendance campaigns.

Many firms testify that "the union in this plant is harder boiled with absentees than management"; that business agents "seem to be trying conscientiously to help us," etc. Both houses of labor at the national level have instituted "stay on the job" campaigns and have concerned themselves with eliminating causes of absenteeism.

Remedying the causes of absenteeism and promoting good attendance requires ingenuity and persistence. When done best, it has been accomplished by management working with labor, government and the community.

These recommendations advocated daily and weekly hour schedules which would "maintain maximum output over a long war period." The report pointed out that "when daily and weekly hours are too long, the rate of production tends after a period to decrease, and the extra hours add little or no additional output; and the quality of work may deteriorate during the whole period of work, not only during the hours of overtime."

Illness, the greatest single cause of absenteeism, is frequently an outgrowth of industrial fatigue due to long hours. Several specific measures have been adopted by plants in an effort to counteract the effects of overwork on their employees' health.

VISUAL GAGE INSPECTION

By C. M. Bradford

AN important stride in the visual inspection of precision gages has been made in the development of Black-Magic, a one bath process that turns steel a rich blue black. The most significant application of the process in connection with gages is that it sharply reduces the excessive cost of constant checking for wear.

Black-Magic is a permanent finish that cannot be rubbed off and will not fade, chip or peel. It is a penetration, not a deposit, and therefore does not alter any dimensions of either inside or outside surfaces. It neither hardens nor draws; in fact it does not in any way change the steel except to blacken it.

With just one immersion at 300° F, the Black-Magic will penetrate to a depth of .0001", a standard gage tolerance. The gage will retain its rich black finish until .0001" of the metal is worn away. This factor is a positive indication of accuracy. Inspectors know at all times the condition of the gage they use . . . . when the bright metal shows, the predetermined tolerance is obviously gone. With this loss of tolerance so readily apparent, the many hours ordinarily lost in checking and rechecking gages for wear are saved.

An interesting test involving two one-inch thread gages illustrates other advantages of the process for gage testings. One of the gages was plain steel and the other penetrated with Black-Magic. Both were carefully measured and subjected to identical tests, first for 7,000 gage operations, then measured with precision instruments, and finally the tests were continued until each had been subjected to 20,000 gaging operations. At the end, both showed the same amount of wear. However, there was no evidence of stain on the blackened gage, but stains from salt on the hands of the inspector were evident on the untreated gage. Small nicks or burrs on the threads were easily detected with the naked eye on the blackened gage, but could be found only with a strong glass on the plain steel.

This ability to detect wear, damage, flaws in the metal, corrosion and stain merely by visual inspection guarantees the complete trustworthiness of the gage at all times. It is also a sure protection against malicious tampering with the measuring tool.

Black-Magic, moreover, assures a smoother fitting gage, with less binding and reduced marring of soft metals. Further indication of its practicability is the fact that gages may be reprocessed with the black oxide finish until the tolerance is entirely used up.

The Black-Magic process, developed by the Mitchell-Bradford Chemical Co., Bridgeport, Conn., achieves full depth of penetration at 300° F with only one bath. It is a final finish for all steel except stainless. It will withstand heat up to 1000° F without affecting the color. Furthermore, steel parts may be shaped or drawn after finishing without disturbing the surface.

The processing itself is simple. The parts to be colored may be strung on wires, placed in baskets or on racks. Since cleanliness is absolutely essential, they are first immersed in an alkali tank, then rinsed in hot water, both at 180° F. Then they are immersed in the boiling Black-Magic tank for the time necessary for color and penetration. Finally they are rinsed in clean, cold water. If an oil finish is desired, the parts can be placed in a soluble oil tank at 180° F for three to five minutes.

CARBIDE SCRAPERS
REPLACE "WORN OUT" FILE

By H. Crump, Carboloy Company, Inc.

THE worn-out file, once the stand-by of scraping departments in tool rooms of machine shops, seems to be coming a war-casualty. With the advent of the war and the stress of getting production out fast, commercial scrapers tipped with cemented carbide are taking its place for finishing both iron and steel castings.

Reasons for this are not difficult to find, but it took a war to raise the lowly scraper to such a position of eminence that at least one company now makes a business of making nothing but cemented carbide scrapers.

Prime cause of the development of this new tool was the need for accelerating production of machine tools. One of the bottlenecks in machine tool production was the necessity for carefully hand-scraping the ways and slides to high degree of finish and accuracy. Steel scrapers—mostly converted files—proved too slow. A few scrapes and they had to be sharpened again. The introduction of flame-hardening aggravated the problem

since the hardened surface further decreased the life per grind of the steel scraper. Some steel surfaces with weld spots could not be scraped at all .

Independent tests carried out at the Battelle Institute at the instigation of one of the leading machine tool builders revealed that by tipping scrapers with cemented carbide, the formerly unscrapable surfaces could be scraped with a longer life per grind than the previously most easily scraped materials.

For instance it was found that on flame-treated cast iron with a Rockwell "C" hardness of close to 40, 25½ sq. in. could be finished per grind with a carbide scraper as against none for the converted carbon steel file. Carrying the tests out further, the best results on any material from 10 to 32 "C" scale hardness obtained with a carbon steel scraper was less than one-third the surface scraped on the toughest material with the carbide tool.

An incidental advantage noted in the tests was that the tipped scraper was free of any tendency to scratch or dig into the surface being scraped, a common trouble with the usual carbon steel scrapers.

The new scrapers are being made with special steel handles, strong enough to withstand pressure without deflecting or bending, such as is the case with cold rolled steel of relatively thin section.

SIX PRINCIPAL STEPS
IN REHABILITATING MACHINE TOOLS

WORN, damaged and overage machine tools from various Westinghouse Electric and Manufacturing Company plants are returned to the Company's Nuttall Works, Pittsburgh, Pennsylvania, for rehabilitation.

Machines already handled under this repair plan include turret lathes, engine lathes, vertical millers, shapers, drill presses, boring mills, internal and external grinders and screw machines.

To insure prompt delivery of the most urgently needed tools a scheduling system has been set up to class the job A, B or C, according to shop priority.

Here are the six principal steps taken to return these veteran tools to their battle lines.

1—As soon as received, the tools are uncrated and outside surfaces thoroughly cleaned.

2—Next the machine is completely dismantled and all parts are tagged and identified as to machine and order number. All parts are then cleaned.

3—Each part is carefully inspected to see if it is suitable for re-use. If not up to standard a new part is furnished. If the part cannot be purchased it is made.

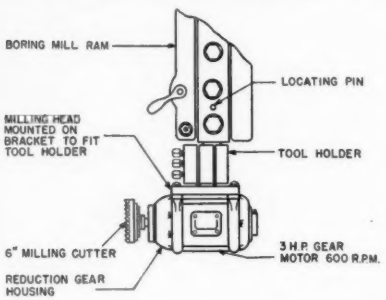
4—Ways, vees or other surfaces which require machining are then accurately scraped. While this work is being done replacement parts are being gathered at the assembly point.

5—The same careful workmanship goes into the reassembly of the tools as in their original building. After assembly the machines are given a run in test and then a final check.

6—The final step is repainting. The body or machine proper is painted machine tool gray, while starting levers and operating parts are painted a contrasting buff. After a final complete check the machines take their places on the production lines.

MILLING HEAD ON BORING BAR IS TIME SAVER

BY mounting a milling cutter on a vertical head of a boring mill, the General Electric Company has found it possible to eliminate setup and handling time, as well as to save time in moving a job to another work station in order to mill one or more flat surfaces. The scheme has also been used to advantage in milling flat, true surfaces in correct relation to a previously machined curved surface. One application has been in milling flat pads on aluminum castings while clamped in the boring mill. The


BORING MILL RAM
LOCATING PIN
MILLING HEAD MOUNTED ON BRACKET TO FIT TOOL HOLDER
TOOL HOLDER
6" MILLING CUTTER
3 H.P. GEAR MOTOR 600 R.P.M.
REDUCTION GEAR HOUSING

MILLING HEAD ON BORING MILL

pads are located inside the bore of the casting.

As shown by the sketch, the method devised by Clark R. Pfeiffer of the Company's Schenectady Works calls for a three-horsepower, 600-rpm gear-motor

mounted base-up on a "T" bracket adapted to fit the tool holder of the head of a six-foot boring mill. A six-inch milling cutter is attached directly to the end of the shaft of the gear-motor. After the milling head has been correctly positioned, a dowel pin is put through the head and into the shank of the tool holder.

To use the milling head the operator first correctly locates the job in relation to the milling cutter. The amount of stock removed may be measured in terms of the scale on the rail of the mill. The cutter is then started and hand-fed into the work. "Rapid traverse" may be used to move the cutter over long distances between intermittent cuts and also to back the cutting head away from the work. A coolant is applied to the cutter.

CENTRALIZED TOOL GRINDING

ALTHOUGH most larger plants are sufficiently well acquainted with the advantages of centralized grinding of cutting tools to have set up such departments, it is surprising to note in how many plants tools are still being ground by machine tool operators themselves with consequent loss of productive time.

"Centralized grinding", it should be pointed out, does not necessarily mean a single grinding room for an entire plant. There may be several such departments, depending on the plant layout and trucking distance to and from machines.

Outstanding of the many advantages of centralized grinding is the reduced "down time" on productive machines.

Not only can the machine operator devote his entire time to keeping production going, instead of taking time out to grind tools with the machine stopped, but the improved tool sharpening resulting from centralized grinding will usually also reduce materially the frequency of shut-downs required for tool changes.

Although shut-downs for tool changes are less frequent with carbide tools than with steel tools, the advantages to be gained from centralized grinding are even more pronounced as may be seen from the following comparison of the two methods of handling tool grinding.

Lower Cost

An important advantage of centralized grinding is the reduction in cost achieved. In the first place, centralized grinding requires less equipment than where such equipment is distributed throughout the plant. Experience indicates that there is usually a minimum of idle time for such equipment as the time can be budgeted in maintaining the required supply of re-ground tools ready for use.

In centralized grinding rooms, furthermore, plants can usually afford to have one or two bigger and faster machines for hogging off front and side relief (clearance) of steel shanks. One or two such machines are usually sufficient to hog off all the steel shanks. This is particularly important in grinding carbide tools for which special grinders equipped with special wheels are desirable to grind the tip properly. Such grinders are not as efficient when used to grind the shank of the tool.

In localized grinding on the other hand, the tendency is to use a multiplicity of smaller machines with small wheels and individual dust collectors on account of their lower individual cost, thereby increasing grinding time and cost. In centralized grinding a single larger and efficient dust collector installation generally suffices for the entire department. This provides more healthful conditions for the operator and longer life for the grinding machine due to less abrasive accumulation.

Also contributing to lower operating cost is the reduced inventory usually required when grinding is centralized. This reduction applies not only to wheels, etc., but also to tools themselves, particularly where "standard" carbide tools are used. Such standard tools may be re-ground as returned permitting the maintenance of a small floating bank of tools ready for use. This usually is reflected in a smaller number of tools in

circulation in the plant, especially where several operations have to be performed on one machine. Where templates are used for grinding tools, centralized grinding usually enables a considerable reduction in the number of templates required to sharpen the tools in the plant.

Better Tools

Contributing more than may be appreciated to a reduction in tool cost in centralizing tool grinding are such factors as reduction in supervisory costs, tool spoilage and grinding time, as well as the greater grinding proficiency achieved.

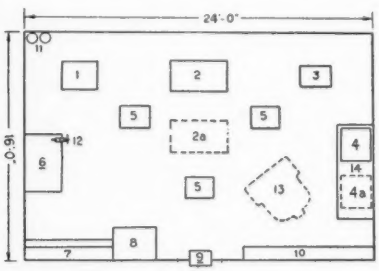
With localized grinding of tools, supervision by competent men is fairly costly, while supervision of grinding by foremen or gang-bosses requires intensive training for a considerable number of individuals. With centralized grinding, supervision is simplified and the number of men required to assure a good job is vastly reduced. This is aided by the fact that men who specialize in grinding tools in a central department are usually vastly more interested in their job than the machine operator would be. In addition, the grinder has a responsibility not only to his supervision but also to the machine operator who will be using the tools he grinds.

That men who grind tools practically all the time will attain a higher proficiency in the art is rather obvious. This results in reduced tool spoilage and assurance of maximum performance of the tool on the machine, particularly with carbide tools. While best grinding procedure for the latter is quite simple, it does differ materially from grinding steel tools. Improper grinding has spoiled many a carbide tool.

Another characteristic noted among workers in centralized grinding rooms is exchange of ideas on short-cuts or improved or simplified methods of grinding. As a result of this as well as previously mentioned factors, grinding time—when centralized—is considerably less per tool than when handled by individual operators. The time of the latter individual is saved, also for productive operations.

In setting up centralized grinding it usually is well also to set up centralized tool control. This enables the setting of a time limit for complicated or expensive tools in continuous operation. It is usually found less costly, particularly with carbides, to sharpen such tools every so often, and keep them in condition, rather than to wait until grinding is absolutely necessary. This insures the tool against damage when used in too dull a condition and also assures maximum machining efficiency.

However, the biggest gain from centralized grinding is with the much-neglected single-point tool, and the number of these used in average plants quickly multiplies the individual savings.



1. Pedestal Grinder equipped with wheels for grinding steel (at least 10" wheel—preferably larger).
2. 10" or 14" Pedestal Grinder equipped with wheels for grinding carbide.
2a. Future Duplicate of 2.
3. 6" Pedestal Grinder equipped with diamond wheels.
4. Chip Breaker Grinder (if tools used extensively for cutting steel).
4a. Future Chip Breaker Grinder.
5. Tool Table on Casters.
6. Bench 30"x48".
7. Stock Bins—Lower section 18"x 6'0"; Upper section 12"x6'0".
8. Shop Desk.
9. Wicket in door.
10. Stock Bins—12"x9'0".
11. Gas Tanks for Brazing.
12. Vise.
13. Future Tool and Cutter Grinder.
14. Bench 30"x6'6".

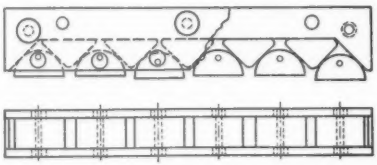
DEVICE HOLDS DIFFERENT SIZE PIECES FOR MILLING

A UNIVERSAL pressure equalizer for clamping multiple pieces of different thickness which cannot be held in a standard clamping device has been developed by Daniel Wollpert of General Electric's radio transmitter planning department.

It is constructed with movable parts that allow pressure to be shifted and equalized across the face of the clamp. Multiple pieces then can be held tightly even though there is a variance in their thickness due to machining tolerances. An ordinary vise could not hold a multiple of pieces tightly enough for machining purposes.

The shifting of pressure is accomplished by allowance for movement of the equalizer parts, which consist of half round and triangular pieces. When there is a difference in thickness of the parts to be held, the half-round pieces shift their position and the triangular pieces shift into position behind them, holding the part securely.

The equalizer is primarily for milling and can be used with any standard or cam vise. It is adaptable for clamping either round or rectangular pieces as well as pieces with irregular surfaces such as castings. It can also be used as part of an assembly fixture. When used in a vise it is fastened securely to the movable jaw. The stationary jaw is then made to suit the shape of the parts to be machined and is spaced to match the equalizer.



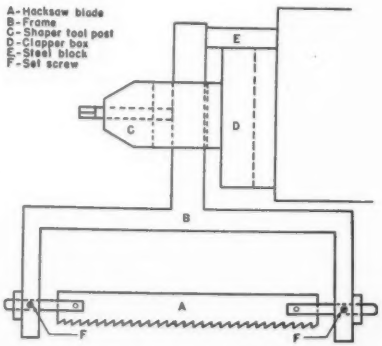
HOLDS DIFFERENT SIZE PIECES FOR MILLING

SHAPER USED AS MECHANICAL SAW

C. P. Fisher, Jr.
General Electric Company

When small dimensional material must be cut accurately and there is no power saw available to do the job, a shaper is occasionally used as a mechanical saw at General Electric's Schenectady Works.

As shown by the sketch, the arrangement consists of a metal frame with two standard blade holders. The "handle" projects vertically so that it may be inserted in the tool post of the shaper. Block "E" is placed so that it holds the clapper-box rigid. The setscrews "F" prevent the blade from twisting.



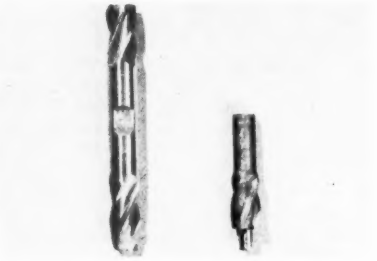
SHAPER USED AS MECHANICAL SAW

A piece of a file, cut in circular shape and brazed on a countersink, and then placed in a drill motor, has eliminated hand filing of cherry rivets on an exhaust fairings at the main aircraft plant of the Fisher Body Division of General Motors.

COUNTERBORE MADE FROM BROKEN END MILL

As another step in its tool conservation and salvage program the Mansfield works of Westinghouse Electric and Manufacturing Company is making counterbores from broken double-end mills. In most cases two counterbores are made from each broken tool.

In making the counterbores, the end



mill is first annealed, then cut in half. Each part is then mounted in a lathe and a pilot machined. The counterbore is then backed off and rehardened.

Reamers and drills can be reclaimed in a like manner, making various tools from otherwise unusable scrap.

It's just a small gagdet but it's doing its part to help win the war.

That's the way officials of the Fisher Body Division of General Motors describe the suggestion advanced by James Field, a tool repairman, in its Detroit Aircraft Unit plant.

Field designed a drill gage that is cutting down breakage and helping to increase production.

His suggestion is a small piece of steel gauged correctly to line up the flute of a drill to make the sharpening of the cutting edge perfect.

AIRCRAFT STAMPING DIES NOW PRODUCED IN ¼ THE TIME

TO meet the demand for faster production of the multitude of blank and pierce dies needed by the aircraft and other industries, a 300% faster method of manufacturing such dies has just been announced by Algoma Products, 3080 E. Outer Drive, Detroit.

In the Algoma method, dies are produced from templates of the parts themselves. This method of fabrication eliminates the need for special die design. The construction employed also simplifies alterations due to engineering changes.

Instead of the usual complex, time-consuming and costly milling operations, the dies are contour-sawed from chrome molybdenum steel, filed, sheared to size, hardened and welded to inexpensive back-up plates. One-third of the critical alloy steel required in conventional dies is thus conserved. Individually replaceable pierce punches of hard drawn tool steel are pressed into the blank die and matching holes drilled in the blank punch for piercing holes in the part.

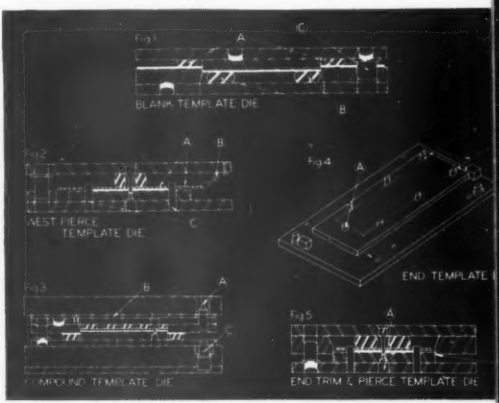
Algoma Template Dies are self-stripping and self-ejecting. Small rubber blocks cemented to the back-up plates near the edges of the punches and in the blanking die are compressed on the down stroke, and in returning to shape on the up stroke, strip the punches and eject the part from the die. Where a large number of pierce punches are required, a thin aluminum alloy plate is cemented over the rubber blocks to equalize the stripping pressure.

All punches and dies are heat treated to withstand continuous production service. Blank punches are cyanide hardened, blank dies flame hardened at the cutting edges, and pierce punches hardened and drawn to 40-42 Rockwell C.

Punch and die are kept in alignment by two guide pins of different diameters in one portion of the die and matching hole in the mating part. The different diameters prevent incorrect assembly of the dies in the press.

Complete die assembly is designed for installation in standard die sets of a popular make, or on press bolster plates with the proper shut height. Two mounting holes in each back-up are held to fixed dimensions for each range of die size so that all dies are interchangeable on standard die shoes.

Available for either single, compound or progressive operations, these template dies are adaptable to blanking and/or piercing from sheet stock or stock sheared to the width of part. In the latter operation, individually removable nest pins are inserted in the face of the die to guide the work.

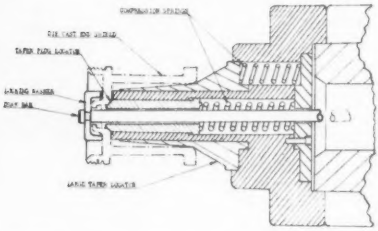


Typical dies being produced by the Algoma process. Note: Blocks of rubber for stripping (Fig. 1-A); for ejection from the die (Fig. 1-B); Alignment guide pins of different diameters to prevent incorrect assembly (Fig. 1-C); thin aluminum plate to equalize stripping pressure (Fig. 2-A); chain supports (Fig. 2-B); inserted work-locating nest pins (Fig. 2-C); Die to shoe mounting cap screws (Fig. 3-A); Spring supported dowels to blow off slugs (Fig. 3-C); Separate back-up plate for punches in the larger size dies (Fig. 3-B); stop pins for one-end cut-off (Fig. 4-A); end trim and pierce die obtained by merely inserting pierce punches (Fig. 5-A); end trim die for either sheet stock or stock sheared to the proper width (Fig. 5-B).

Device permits castings to be simultaneously chucked and centered

The chucking of pressure die castings for small motor end shields is accomplished easily and accurately through a special chucking fixture developed by A. J. Green, a general foreman at a General Electric plant manufacturing aircraft parts.

The fixture employs a spring-mounted



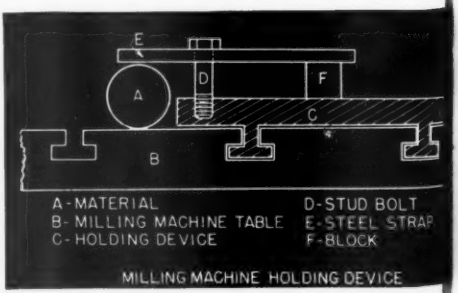
tapered plug and a similarly mounted tapered ring which locate the bearing bore and the edge of the stator fit. The end shield is located against a three-point stop which contacts the inside of the end flange, evenly dividing excess stock in the casting. The end shield locates first against the spring mounted plug, assuring a concentric location of the outer end, and then is pushed back until it locates solidly against a three-point stop. Coincidentally, contact is made at the inner end on the large taper locator, obtaining a concentric location of the large fit. The air-operated drawbar pulls a horseshoe washer which has three locating points directly opposite the point on the stop.

This arrangement permits the casting to be solidly held without stressing any of the weaker sections since the holding force is applied directly in compression against three points through the end flange. When the air cylinder has drawn up to its full stroke, the casting is held accurately and solidly, and the resulting turning operations may be done quickly and accurately without necessitating the use of highly skilled or experienced operators.

Device holds small work on large tables

A device for securely clamping material of smaller diameter than the space between the T-slots of large milling machines has been devised and put into use at General Electric's Schenectady Works.

As shown by the drawing, the device consists of a steel plate "C" with two T-shaped projections which fit the grooves of the miller table. A tapped hole near the end of this plate receives stud bolt "D". By tightening the bolt down on block "F" and the work "A", the work is held firmly for machining.

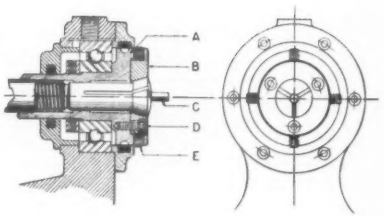


MILLING MACHINE HOLDING DEVICE

NEAR-PERFECT CONCENTRICITY
IN LIGHT LATHE WORK

By replacing the regular bench lathe spindle by a "bell end" spindle and incorporating a central disk in which the taper portion of the collet seats, practically perfect concentricities are obtained in machining tiny parts for meters and instruments.

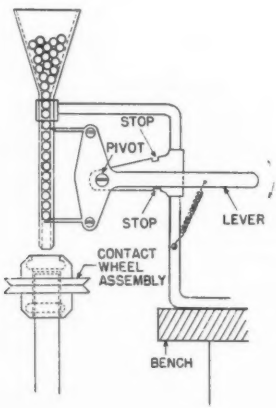
The changes are made without altering the effective length of the spindle or draw bar. As shown by the drawing, "A" shows the bell end of the spindle; "B" is the disk which receives the collet "C"; "D" indicates the three screws which hold the disk fast after four screws "E" have been used as jack screws to adjust the collet to concentricity.



LOADS BALL BEARINGS EASILY

LOADING of ball bearings into contact wheel assemblies for radio transmitters in mass production has been simplified by a fixture devised by W. D. Simpson, an assistant general foreman in the General Electric Electronics Department.

It consists of a funnel-shaped hopper with a tubular section attached to its lower end. The inside diameter of the tubular section is just slightly larger than the diameter of the ball bearings so that they will pass through it in line and without congestion.



A lever arrangement pivots from the frame holding the hopper in a manner that pushes two pins through the walls of the tube alternately at two locations. In this particular application, the pinholes have been located so that between them there is room for 9 ball bearings in the tube. An upward movement of the lever withdraws the lower pin from the inside of the tube allowing the 9 bearings to drop into the contact wheel assembly. The same movement injects the upper pin into the tube preventing more than 9 bearings from entering the assembly. Spring return of the lever to its lower, normal position simultaneously reverses the position of the pins, automatically permitting another 9 bearings to fall into the space in the tube between them.

A vertical slot in the side of the tube permits a visual check of the bearings during the operation of the device.

NEW DEVELOPMENT IN SHORT RUN DIES

by D. A. Rogers
Dayton-Rogers Manufacturing Co.

IN the developing and perfecting of a new stamped metal product, alterations of design have been a source of major expense. The valuable time of a skilled workman and essential tool steel go into the making of "permanent type" dies formerly needed to effect each change in pattern. Never considered an economical method, in war time, what may be unnecessary use of critical material or craftsmanship is dangerously costly.

To overcome this problem, the Dayton Rogers Manufacturing Co. of Minneapolis, Minn., has developed a new type automatic electric punch press that makes possible 100% flexibility as to tool changes, while keeping the initial cost of the tools at a minimum. The use of the blanking and piercing dies manufactured in small lots by Dayton Rogers allows altering the shape of a part without affecting the punch and die for piercing. The piercing die can be altered without affecting the construction of the blanking die.

The size and location of the pierced holes in the average die cut stamping is the most important detail on the finished blank. With the new piercing press, it is possible to change the hole size and location of holes in a given group of pierced blanks to any size and location required with the minimum cost. The hole sizes in the pierced blanks can be produced in any size from .015" to 1⅛", progressing by .001", and the presses are so arranged that hole sizes and location of holes can be changed on one group of blanks to another without disturbing the production capacity of the presses.

The presses are made in two sizes, with a throat capacity from 12" to 14" and a maximum tonnage of 15 tons. The slide stroke is 1¾", with a ram adjustment of 2". The presses are provided with a shut height for a die space of from 2" to 3". Each one is completely self-contained and individually motor driven, and may be plugged into the power line anywhere in the plant.

The ram movement is carried at the bottom or bolster side of the press, the punch on the upper section, and in all cases the punch is stationary. The ram also carries the die. The flywheel has an electric clutch with automatic releasing brake built into the base of the machine. Each machine is provided with its own working guard, which, when removed, automatically throws the power switch of the individual press.

These die piercing presses may be easily grouped together (see Fig. 1), an advantage when the work has to be passed from one press to another.

The automatic trip is so arranged that once the work is in correct point for operation, the machine automatically goes through the required working cycle, and then is locked out until the next piece is put in correct position, thus eliminating the hazard of having the operator trip the press manually when the work is in position. This method makes for positive protection at the point of operation. With this automatic safety feature, it is possible for the operator to work the machine to its maximum production. In case of current failure, the die piercing press automatically locks itself out.

Industrial Digest

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

Short Cuts to More Props

The increasing demand for more and more props was a signal to production men at Hamilton Standard Propellers division of United Aircraft that machine tools must be operated to their utmost efficiency, and every possible short cut found and used. The problem was to adapt operations wherever possible to machine tools on which reasonable delivery could be obtained, or to make one machine do the work of two or more.

An example of this type of planning was the substitution of a Morton keyseater, not in great demand, for a Pratt & Whitney vertical shaper with a rotary table—a machine difficult to obtain. The Morton keyseater was smaller, and less expensive to boot.

The operation performed by the two machines in this case was the generating of a hex into the part which serves as a combination piston and propeller retaining nut on all controllable pitch propellers. This hex permits the use of a wrench in adjusting the part.

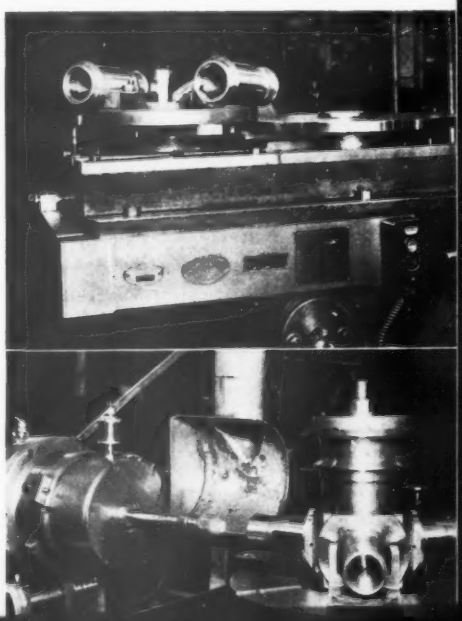
A Geneva motion with a cam arrangement was utilized on the Morton keyseater, the feed mechanism being obtained from the cam and the divisions from the Geneva motion. This simplification in operation eliminated the need of a skilled operator, conserved floor space, provided an 80% saving in labor, and increased production 40%.

Smooth finish of parts under stress loads, such as the spider which positions the blades, is always necessary in propeller making. The arms of the spider are bored through the center to cut down weight, and all these bores must be polished. Previously, a turret lathe was used and 18 minutes were required for each operation.

Production men of Hamilton Standard and Cheney Bros. designed a special eccentric polishing head, with the eccentricity obtained by the utilization of cams. Incorporation of a work holder and a feed mechanism made the machine semi-automatic, and a special bob was designed to form the radii at the bottom of the armhole.

The operator now places the work in the holding fixture, starts the machine,

Top:-Morton Keyseater, through use of special features, is converted into an automatic machine.
Below:-Special eccentric polishing head.



and actuates the eccentric spindle to a stop which performs the required operation. Then the work is indexed and the same procedure followed for a second time. The entire operation is now performed in less than one-third of the time required with a turret lathe.

Hydromatic propellers require a large quantity of spring pack retainers, sixteen being provided for each blade. These small U-shaped parts hold the springs which provide the drive between gear segment and propeller blade for changing the pitch of the propellers.

Originally a specially formed extruded bar stock was used. This was first milled out through the center, broached, and then parted to the proper size. It was then necessary to grind the outer surfaces of the retainers to the proper close tolerance.

Hamilton Standard production men, however, developed an automatic machine for the job, using a self-fed LaPointe broach. Careful analysis of the job enabled the substitution of Standard rectangular bar stock, accomplishing a saving in raw material and eliminating the problem of obtaining special stock. Further, in order to secure the required volume on one machine, it was rigged to produce three complete retainers for each pass or stroke.

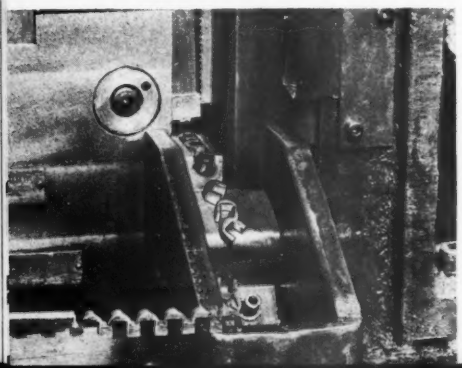
Now the rectangular stock is fed through a trough into the machine by a hydraulic floating clamp, which eliminates distortion of the material and friction in the feed mechanism. Instead of milling out the center of the steel, three slotting broaches cut in from the side of the bar stock to an accurate tolerance, slotting three individual pieces at one stroke. The bar then automatically feeds to the next position, with special index features assuring proper alignment.

The second operation, forming the three radii on the opposite side of the bar from the slotted side, is done by a special forming broach. Again the bar feeds to the next position and the piece is indexed for the parting of the first three units—those which have been slotted and on which the radii have been formed. This is done by hack saws operating as broaches.

When the machine is in operation and the bar stock has started to feed, all three operations are performed simultaneously; and at each stroke of the machine, three complete units are ejected. An analysis made since this specially tooled LaPointe broach has been in operation discloses that the cost per unit for the spring pack retainers has been cut 75%.

[*This is a digest of an article appearing in a recent issue of "Steel Horizons," an Allegheny-Ludlum Steel Co. publication.*]

Specially tooled La Pointe broach turns out spring pack retainers



India Skilled In Machine Tool Industry

In the industrial mobilization of every nation, machine tools hold a pivotal position. While, in normal times, Britain and the United States are noteworthy producers and exporters of machine tools, the exigencies of the war have given important impetus to the growth of the industry also in

Canada, Australia, S. Africa and India. The value of Canada's output of machine tools rose from $500,000 in 1939 to an estimated $40,000,000 in 1942. Australia and S. Africa have, too, made significant progress, despite difficulties.

India, fast becoming an arsenal of the Middle East, had to start virtually from scratch. In her case the basis of experience on which machine tool manufacture is developed had been even more fragmentary than with Australia and Africa. The latter had as a background a local engineering industry from which to project a collateral industry like making machine tools.

In India there was practically no productive engineering industry before the war. The few engineering workshops in which the craft was practised served almost exclusively to maintain the plant of India's other industries. There were, however, several Ordnance factories and, of course, the railway workshops.

These Indian Ordnance establishments and railway workshops proved an invaluable asset to the country when the authorities were confronted with the problem of turning it into a supply base and center of war production, and of training thousands of its citizens in engineering. Machine tools were found indispensable to make a success of the training scheme, and by the second year of the war 71 licenses had been granted to local firms for manufacturing tools.

Rapid Training Advance

Up to a year ago at least 50 of the licensed undertakings were turning out simple tools including capstans, drilling, shaping, planing and slotting machines, as well as hacksaw machines, presses, blowers and other related products. Output of such products towards the end of 1941 was estimated at 400 units a month.

By now the production rate must be appreciably higher. Demand for gages, jigs and tools provided a practical illustration of the value of the railway workshops. In a very short time they were manufacturing 1,000 gages a week for the rapidly expanding ordnance factories, while from the well-known Indian iron and steel firm of Tatas, 50,000 tools of various types were emerging every month.

Training of workers for all the varied skilled occupations was quickly organized, and India's training capacity increased beyond expectations. Soon after the outbreak of the war, fewer than 1,000 trainees could be accommodated, and another 2,000 appeared to be the maximum for the future, provided additional instructors and tools were forthcoming. But by 1941 India had at least 300 training centers, offering scope for improving the engineering skills of 25,000.

They Come to Britain

The Indian Government's technical training scheme is augmented by the British Ministry of Labour plan through which Indian workers with some previous engineering experience are sent to Britain for a course lasting nine months. On return to India they are appointed to a position where their special training and experience are likely to prove most beneficial.

In the railway workshops, hundreds of Indians are now being trained as machinists, fitters, toolmakers, millwrights and draughtsmen, and when qualified they are posted to military and other essential industrial establishments. Despite the progress made, however, India continues to rely on Great Britain and the United States for many lines of special-purpose, complicated, high-production tools. And, notwithstanding their own vital need for such machines, the Anglo-American authorities are doing their best to meet India's needs.

This is a digest of an article by V. S. Swaminathan, M. A., M. S., appearing in Machinery Lloyd, No. 7, 1943, London, England.

PRECISION MEASUREMENT

by Arthur Clifford
in collaboration with
Jansson Gage Company Engineers

MEASUREMENT is one of the oldest of the sciences. In prehistoric times, though still unable to count beyond his ten fingers, Neolithic man had already begun to make crude estimates of distance, direction and size.

By the time of the Egyptian and Sumerian civilizations, or 5,000 to 6,000 years ago, a number of remarkable feats in measurement had been achieved. The length of the solar year had been reckoned, correct to within 7 hours. Eclpses of the sun and moon could be predicted. The value of symbol for Pi—or that number which, when multiplied by the diameter of any circle, equals its circumference — had been approximated.

The method of measurement by the use of angles—just as today mechanics use a sine bar—was known and widely used. By its means the pyramids were constructed to an accuracy that today seems little short of incredible. The Pyramid of Cheops, for example, which was erected nearly 5,000 years ago, shows an average error at its base of less than .0001 of the side in equality, squareness and level.

More than 2,000 years ago, or about 1,600 years before Columbus discovered America, the circumference of the earth had twice been measured, yielding a figure only 50 miles in error. At about the same time the astronomer Hipparchus measured the distance from the earth to the moon with less than 5% of error. Previously, another astronomer, Eratosthenes, had measured the distance to the sun, giving a figure that, for all practical purposes, still stands.

Despite these and other equally great accomplishments, the standards of measurement in those days and for centuries afterward were not fixed but were generally based upon parts of the human body. This is the reason why, even today, measurements are made in *feet*, and horses are so many *hands* high. In fact, so natural and convenient are such methods, that farmers still pace off distances in their fields, carpenters measure inches with their thumbs, and recipes often call for a *pinch* of salt.

Thus, the Egyptian and Sumerian cubit was the length of the forearm from the elbow to the middle finger tip. Two-thirds of the cubit was about equal to the human foot; this the Greeks divided into twelve thumbnail breadths corresponding to inches.

The Anglo-Saxon fathom was equal to two arms outstretched. Since it was easier, when measuring cloth, to use but half this distance—stretching out one arm and bringing the other hand to the middle of the chest, as many clerks still do—a half-fathom was adopted and called a yard. This yard, since made uniform so that tall and short men could both use it and mean the same thing, is the official standard today in Britain and, by reference to the meter, the United States.

How the yard was standardized is an interesting history in itself. The reigning king's physical dimensions were the accepted standard in early England. When one king was succeeded by another the British presumably burnt their yardsticks. Seeking a basis of greater logic and permanence, the 16th century rod made reference to the average man by lining up 16 men as they left church on Sunday and measuring the total length of their left feet. The Queen Elizabeth yard, cast in bronze in 1558, fixed its length for nearly 300 years. The present official yard was cast almost 100 years ago, but not until 1878 was legal notice taken of its liability to fluctuate, by an act of Parliament setting 62° as its proper measuring temperature.

Meanwhile an entirely new standard of weights and measures, known as the metric system, was devivsed in France at the close of the 18th century. This has as its basis the meter which, unlike the yard, can never be lost, since it is defined in terms of light waves, accurate

to .0000001 of its length. The meter was originally intended also to bear a definite relationship to the size of the earth, being .0000001 of its meridian quadrant. However, though these measurements of the earth's circumference were made 20 centuries after the estimates of Eratosthenes and Poseidonius, they too were later found to be in error. Hence, in 1927, the meter was re-defined as follows:

"The unit of length is the meter, defined by the distance at the temperature of melting ice between the centers of two lines traced on the platinum-iridium bar deposited at the International Bureau of Weights and Measures, and declared prototype of the meter by the first general conference on weights and measures, this bar being subjected to normal atmospheric pressure and supported by two rollers at least one centimeter in diameter situated in the same horizontal plane and at a distance of 5.72 millimeters from each other."

Astronomers for years have been able to measure distances so vast that to write down the number of miles would more than fill a page, yet precise measurement is a relatively modern development.

To be sure, the principle of the vernier, which splits inches into thousandths, was discovered in 1631. But 220 years were to elapse before this principle was applied in the practical form we know today; namely, the vernier caliper of Joseph R. Brown. Likewise, in the year of Brown's caliper—1851—Sir Joseph Whitworth invented the first measuring machine using end standards. This machine was capable of detecting differences as small as .000001". Yet, the ability to *measure* such differences with the extremely sensitive comparators used today by gage block manufacturers, arrived a half-century later.

In 1843, M. Palmer of France invented the micrometer, calling it the Systeme Palmer. Joseph Brown saw it at the Paris Exposition of 1867 and produced a replica of it, calling it a Pocket Sheet Metal gage. This and the similar device produced by Wilmot in 1867 are believed to be the first America nmicrometers.

Equipped with a vernier, a micrometer is theoretically capable of measuring to an accuracy of .0001". Yet, a certain amount of error is built into the micrometer itself. Thus, in 100 measurements of the same part, using a particular micrometer for test purposes, readings varied .0012". The greatest number of identical readings was 22. Assuming these to be the most accurate readings, the micrometer in reality measured to .0001" only 22 per cent of the time.

Recognizing this, C. E. Johansson, of Eskilstuna, Sweden, devoted many years of labor and research to the problem of reducing this inaccuracy to the lowest possible limits. In 1897 he produced his first set of precision gage blocks guaranteed to have an error of less than ±.000016" per inch of length.

So slow and painstaking was the task of manufacturing these blocks that 14 years elapsed before they could be produced in commercial quantities. Still not satisfied, Johansson continued his work, aiming for greater and greater accuracy. In 1929 Johansson produced the first chromium plated gage blocks, and this method was and is extensively used to restore worn blocks to their original dimensions.

In the early manufacturing of gage blocks the blocks were allowed to season for several months before finishing in order to eliminate the changes taking place from ageing. This method was too slow and artificial methods of seasoning have now been developed that shorten the process from months to days.

After seasoning the blocks are machine-lapped to about .0001" oversize. Then they are hand-lapped by experts, taking long, slow strokes on a surface plate. Though the finest emery dust is used on these plates, so critical is the standard of flatness required that they must be refinished each day.

As the lapping proceeds, each block is compared with a master, using a comparator that measures differences of .000002". Flatness and parallelism are tested by means of an optical flat which utilizes the spectrum, or color bands into which daylight is divided, to detect out-of-plane conditions. When the perfectly flat block has been lapped within the limits required, it is etched, and given a final inspection.

Care of Gage Blocks

Gage blocks, being of steel, are subject to rust . To protect them from moisture in the atmosphere they are covered with petroleum jelly at the factory before packing. They reach you in a specially built case having a compartment for each block, identified by the dimension engraved on the block.

There is no need to remove the grease coating from any block until that block is used. Then it may be wiped off with a clean soft cloth, piece of chamois, or cleansing tissue, or else immersed in kerosene or similar cleaning fluid. After use the block should be wiped with a clean dry cloth and again coated with petroleum or dipped in oil. Cleaning before coating is necessary, especially if the block has been handled, since the hands deposit an acid which causes rust even under the grease film. Needless to say, the block should not be touched by hand after receiving its rust proof coating, but should be placed in the case by means of a cloth or pair of tweezers. Individual b l o c k s and combinations should never be left lying around loose.

Extraordinary care must be taken to protect the lapped surfaces of the gage blocks from rust, wear, or other damage. Practically speaking, when you buy a gage block you are actually buying only these two surfaces, and to a depth of but a few millionths of an inch. If either is damaged the block is valueless.

For this reason it is good practice to avoid touching the lapped surfaces of the block any more than necessary. When lifting a block from its case, grasp it at the top and bottom. When cleaning, wringing to another block, or taking measurements, hold at front and back. Above all, never drop or strike the lapped surface, and take exceptional care to avoid scratching or rubbing it against the work while gaging.

The principal cause of ordinary wear will be wringing to form combinations. This can be reduced materially by observing two simple rules: (1) make certain the surfaces are clean before wringing; (2) bring the two blocks together in such a way that no possible chance exists for scratching or scraping.

Since gage blocks that are perfectly dry will not wring together, the lapped surfaces are coated with a film of oil before attempting to make a combination. This film need not be very heavy; indeed, there is enough oil on the surface of one's skin to satisfy the requirements. The usual practice is to pass the block lightly over the wrist or palm of the hand, making sure the hands are clean. Minute particles of grit, too small to be seen, will nevertheless cause unnecessary wear.

Holding the blocks by the ends, if small, or by front and back, if large, they are brought together at right angles to each other, making their first contact at the centers of the prepared surfaces. Now follows a slightly sliding, circular motion when, if properly prepared, the surfaces will cling together almost instantly. Still using the same sliding motion, the blocks are further rotated until their full surfaces are in contact.

Though a 200-pound pulling f o r c e would be insufficient to break gage blocks apart, once they have been wrung, separating is even easier than wringing them. They are merely slid apart, turning them first at right angles, then sliding one off the other. Blocks should not remain wrung together overnight, however, or separation may be difficult. Good care as we have observed, requires their separation promptly after use, along with cleaning, oiling, and replacement in the case.

At intervals of six months, or oftener if they are in constant use, gage blocks should be returned to the manufacturer for inspection and certification. Ordinary wear will reduce the size of a block one to two millionths with every hundred combinations. Additional wear will occur when gaging hardened parts or gritty surfaces. When blocks are regularly certified the extent of this wear is always known and can be allowed for in measuring, or minimized in making up combinations. Blocks showing least wear may be put to greater use, thus distributing the normal wear and prolonging the life of the set.

By passing sets along as they become worn, just as father's suits are passed from older to younger brothers, the life of gage blocks may be indefinitely ex-

tended. The most accurate set should serve as a master, against which working sets are checked. As its error grows, it becomes a working set, used for general gage inspection. When the error has increased to 20 millionths it goes over to tool inspection; from there — the error having increased another 20 millionths —to parts inspection, where it should finish its life after a total of .0001" has been worn away.

Use of Gage Blocks

Because gage blocks have a smaller range of error than almost any other general purpose gage, they are frequently used in the checking and receiving inspection of other gages. For this purpose standard accessories consist of inside and outside caliper jaws, holders, straightedge, machinist's flat, scriber, center point, and tram point.

Checking micrometer lead errors, setting sine bars, and setting comparators are other common uses. Less common uses are in layout and checking layout accuracy; parts and process inspection; inspection of tools, dies, jigs, and fixtures; machine tool set-up.

Two stacks of blocks—one for Go, the other for No Go—are used with outside caliper jaws in checking plug gages, and with inside calipers in checking ring gages. No accessories are needed in checking snap and spline gages, or in setting comparators.

Practically all gage block applications require making up combinations, inasmuch as few of the dimensions required will coincide exactly with the dimension of any single block. However, by combining two or more blocks together, a number of different dimensions may be secured, depending on the size of the set.

Three simple rules should be observed in making up combinations. These are: (1) have pencil and paper handy to keep a record of your gage block selections; (2) aim to ues a minimum number of blocks to secure the required dimensions; (3) work from right to left, eliminating the last figure to the right as you go along.

Assume, for example, that a combination of blocks totaling 1.3494 is needed. The first step is to write the number down. Now, to eliminate the last figure on the right, the .1004 block is selected. Subtract this from 1.3494, leaving 1.249. By selecting the .149 block, the last two figures on the right are eliminated leaving a remainder of 1.100. Two more blocks are needed to complete the combination—the .100 and 1.000.

After the blocks have been selected and their dimensions written down, the numbers should be added together. If the sum is correct, the proper blocks have been chosen. Sometimes a single block cannot be found which will eliminate the last figure on the right. In that case, select two blocks for the purpose. If, for example, the .0007 block is not available for a gage .2017" long, combine the .1008 and the .1009 blocks to get the dimension.

Gage blocks, being of metal, expand and contract with changes in temperature. Actually, the length of a gage block is true only at 68° Fahrenheit, and it expands about .000007" per inch of lenght with each degree rise in temperature. This means that, at a temperature of 78°, a 3" block will actually measure 3.000210". In working with metals other than steel or iron this should be taken into consideration either by making sure that a temperature of 68° is maintained in the work room, or by making proper allowance for the difference in expansion between the work and the gage block. The coefficient of expansion for such metals as aluminum, brass, and bronze is higher than that for the blocks; for tungsten carbide, it is lower.

In working with steel, however, which has practically the same coefficient as the gage blocks, it is only necessary to make certain that the work and the blocks are at the same temperature. For this reason measurements should be taken on a surface plate, which induces an equality in temperature. Likewise, it is good practice to allow blocks to cool for a period up to 10 minutes after handling them in making up a combination. So far as possible, even when gaging steel, a room temperature near the 68° standard should be maintained.

Precision block gages are very useful in checking micrometers, as they reveal lead errors which would be missed in the ordinary test of the zero setting and

with a 1" pin. By using blocks in a succession of steps between zero and 1" the inspector can note and record the micrometer's error throughout its entire measuring range. Care should be taken not to grip the block too tightly. The correct pressure is being applied when the block can be slid easily between micrometer anvil and spindle.

Angle Measurement

Precision measurement and checking of angles involve the use of gage blocks in connection with a sine bar. The sine bar, which is simply a straight edge having a hardened and ground plug at each end, is made to form an angle with the surface plate by setting gage blocks under one of the plugs or combinations of different lengths under each of them.

The use of the sine bar is a practical application of one of the basic rules of trigonometry, or the science of right triangles. Simply stated, this rule defines an angle of a right triangle in terms of the ratio of the opposite side to the hypotenuse. This ratio is called the sine of the angle. In practice, the sine bar is the hypotenuse of a right triangle and the stack of blocks is the side opposite. The sine of the angle is found by dividing the gage block dimension (or side opposite) by the length of the sine bar (or nypotenuse).

Because of ease in figuring and somewhat greater accuracy, the 10" sine bar is often preferred for precision work. Then ,if the opposite side of an angle gages 3.0147", it is only necessary to move the decimal point one place to the left to get the sine of the angle .30147. Whereas, if the 5" bar is used, it would be necessary to divide the length of the opposite side by 5, to get the sine. This disadvantage, however, is largely offset by the general availability of tables of values for the 5-inch sine bar. With such a table, values are read directly, no division is necessary.

When an angle is known and must be constructed, the procedure is to look it up in the table, find its sine, and construct two gages differing in length by an amount equal to the sine. The two gages are set upright on a surface plate and the sine bar laid across them, giving the desired angle.

The law of sines and cosines is an old and very useful one. Ancient astronomers used it to measure the earth, the moon, the distance between them, and the distance to the sun. Modern astronomers use it too, more accurately because their angle measuring instruments are more accurate. The story is told that Napoleon, faced with the problem of building a bridge across a river of unknown width, got help from a corporal who was familiar with the law. The corporal lined up two trees on opposite banks, drew a perpendicular, measured the length of his perpendicular and the angle it formed with the hypotenuse, then calmly told the emperor how wide the river was.

Measurement with sine bar and gage blocks is no less dramatic. To be sure, Napoleon won a battle as a result of his ability to build a bridge quickly. Even bigger battles depend on precision measurement.

The very concept of gages accurate to a few millionths of an inch is literally packed with the drama of science. What, exactly, *is* a millionth of an inch? Well

Compared to the thickness of a sheet of newspaper a millionth of an inch is the same as a thimble is compared to a 30-story building!

Compared to one inch, a millionth of an inch is the same as a walk around the block compared to a trip around the world *ten times!*

The Vernier

Everybody recognizes that measurements taken with a simple scale, or steel rule, are mere approximations. Although a scale graduated in 64ths measures in 64ths, the chances of any dimension coinciding exactly with one of the graduations on the scale are extremely remote.

Take, for example, a dimension which the steel rule shows to be $2\frac{3}{64}$". Use of a magnifying glass will in all likelihood reveal the dimension actually to be somewhat less or more than $2\frac{3}{64}$"—how much can only be guessed. Throughout the relatively brief history of precision measurement it has been the aim of gage makers and designers to reduce the amount of this guesswork. All precision gages are attempts in this direction.

(Continued on page 143)

PULL TO DROP TAKE-OFF GEAR
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
HIGH VOLTAGE CONNECTION
3 2 1 0 1 2 3
LOCATION AND LENGTH OF WHEEL TRAVERSE
BRAKE
POSITION #1 — OFF
POSITION #2 — ON
PUMP SPEED 700 S.S.F.
GOVERNOR SET AT 70 S.S.F.
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Precision Measurement

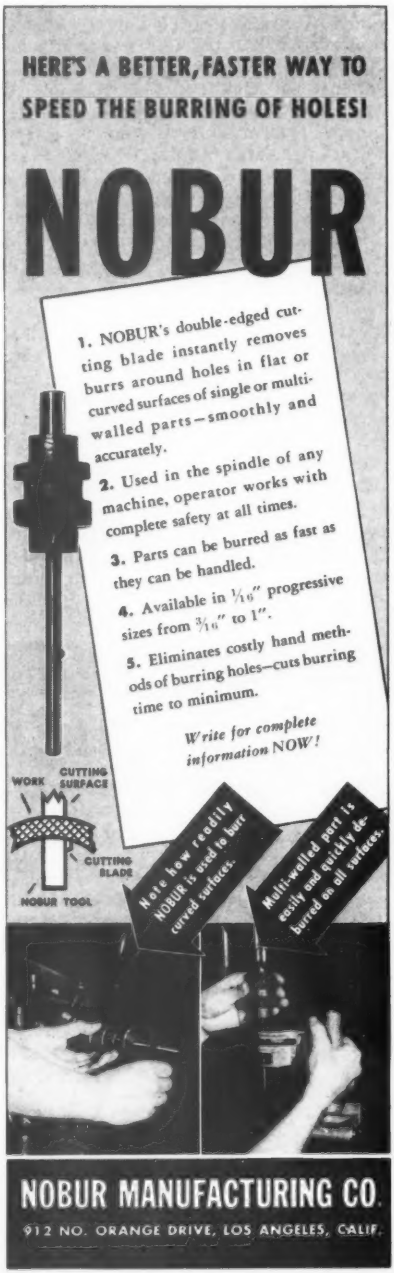
(Continued from page 140)

Some, like gage blocks, rings, and plugs, approach absolute accuracy by material representation, as near perfection as possible, of a single, specific dimension. Others, such as flush pin gages, rely on the sense of touch which is capable of perceiving lesser size variations than the eye. Still others utilize various methods to magnify the measurement. Among these are the machinist's microscope, the dial indicator, the projector, the micrometer, and vernier.

The principle of the vernier is remarkably simple considering the fact that its discovery occurred so late, relatively speaking, in history. Recognizing that graduations as small as .001″ are too small to be physically realized, the modern vernier accomplishes the same thing by matching calibrations that *differ* by .001″. Actually, the vernier on a caliper or height gage is a section of a scale that duplicates the major scale in every respect *excepting that each calibrated distance is .001″ less.*

Since the true scale of any English measure vernier caliper or height gage has 40 divisions to the inch, each division equals 1/40 or .025″. The vernier scale is .600″ long, which is to say that it is equal in length to 24 true scale divisions ($24 \times .025'' = .600''$). However, the vernier has 25 divisions over this length, or one division less than the true scale. Consequently, each vernier division equals .024″ (.600″ divided by $25 = .024''$), which is .001″ shorter ($.025'' - .024'' = .001''$) than a true scale division.

If one vernier division is .001″ less than a single scale division, two vernier divisions are .002″ shorter than two scale divisions, ten vernier divisions are .010″ shorter than ten scale divisions, and so on. Now if the number 10 line of the vernier happens to coincide with a line on the true scale, the zero of the vernier will quite obviously not coincide with any line on the true scale. Instead, it will be .010″ past the nearest true scale line. Likewise if the number 3 or number 17 line of the vernier zero will be .003″ or .017″ past the previous true scale line.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MARTINDALE ROTARY FILES AND BURS—are presented in Catalog No. 24 issued by The Martindale Electric Co., 1417 Hird Ave., Cleveland, O. Martindale Protective Masks are fully discussed and illustrated. Illustrated models are presented and price lists are included. **53-A**

DEE TEE VAPOR CLEANER—for Internal Degreasing and Drying is described in a folder issued by Circo Products Co., 2835 Chester Ave., Cleveland, O. The Dee Tee Vapor Cleaner uses Dee-Solv Solvent, which when heated, creates a constant flow of hot, clean vapors into the housing **52-A**

WALES PUNCHING AND NOTCHING EQUIPMENT—is the title of a new bulletin issued by the Wales-Strippit Corp. of N. Tonawanda, N. Y. Among the unique features described in this bulletin are the self-contained punch and die holder; permanent alignment of punch and die; independent holder for quick removing or resetting on rails, templates or T-slotted plates; unlimited patterns with the same group of units and many others. **60-A**

"UP TO 30 H. P."—a four-page catalog, describes the three models of Western Transmissions for motorizing various cone driven machine tools, just released by Western Manufacturing Co., 3400 Scotten Ave., Detroit, Mich. It illustrates how Multi-Motor-Mount makes practical the adaptation of the three models of Western Transmissions. Fourteen different installations are illustrated. **83-A**

THE UNIVERSAL SLOTMASTER—is described in a four-page catalog released by Experimental Tool and Die Co., 12609 Greiner, Detroit, Mich. It effectively illustrates some of the many ways the machine may be used to save tools and set-ups. A conventional, horizontal, and angular set-up is shown, together with a complete description of tooling for cutting an internal gear, chuck jaw teeth and feed cams . . . broach-

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Tool and Die Journal, 2460 Fairmount Blvd., Cleveland, Ohio

Please send me the literature I have indicated.

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No.....	No.....	No.....

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ing splines, lapping deep impression dies, etc. **61-A**

CONVEYORS IN ACTION—for America at War are offered by the Mechanical Handling Systems, Inc., in a new bulletin. Nearly a quarter of a century's experience in applying the principles and economies of continuous mass production to the peace time needs of a wide variety of American industries has enabled M. H. S. engineers to develop conveyors that help speed the production of war materials. A few typical installation views of handling systems are presented in the booklet as an aid to other manufacturers in solving handling problems with the shop. Request Bulletin No. G-4 from the company's main office at 4609 Nancy Ave., Detroit, Mich. **63-A**

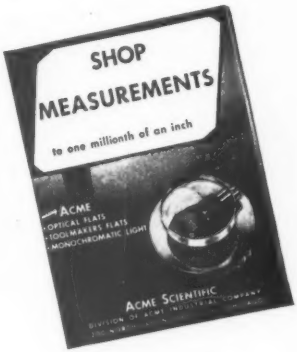
CUSHMAN CHUCK CO.—has issued an attractively bound and very comprehensive catalog which should be of great value to prospective buyers. There are specially indexed chapters on the 4-jaw independent, self-centering, combination two-jaw, light duty and collet chucks, and on replacement parts. Detailed blueprint drawings are included. Write to The Cushman Chuck Co., Dept. C, Hartford, Conn. **64-A**

TWO NEW PLANETARY MILLING—catalogs issued by the Plan-O-Mill Corp., Dept. X, Hazel Park, Mich., are available to production executives inquiring on company letterhead. One is a 14-page folder on the No. 3 Plan-O-Mill for cylindrical parts up to 8" in diameter; the other, an 18-page booklet on the No. 5 Plan-O-Mill for larger parts. The principle of Planetary milling is fully explained and graphically illustrated with the aid of actual case histories of Plan-O-Mill form and thread milling in war production. **65-A**

ANNOUNCING A NEW DEVELOPMENT—in refrigerated welding electrode design, a six-page, four-color Bulletin No. P-43 has just been released by Frostrode Products, 19305 John R St., Detroit, Mich. Completely described are the design, construction, and operation of the "Frostpoint" permanent electrodes with replaceable finned "Frostcaps," also "Frostpoint" adapter holders to convert any spot welder to the process. Color cuts show coolant circulation, improved installation practice, and unique method of cap replacement with electric pliers. Use of this development, the bulletin states, conserves 90% electrode copper, increases welding production, eliminates point dressing, permits more effective cooling and cuts electrode replacement costs. **66-A**

"EVERYTHING FOR SAFETY"—is offered in the new Boyer-Campbell Co. catalog on safety equipment. The 134 pages in the book are devoted to the description of hundreds of effective, scientific accident prevention devices. A copy is available to anyone interested in the protection of the individual on the industrial front. Address the company at 6545 Antoine St., Detroit, Mich. **67-A**

LIGHT WAVE MEASUREMENT—is discussed in a 12-page booklet issued by the Acme Industrial Co. Printed in two colors, the new booklet contains various descriptive charts, illustrations, diagrams and detailed



instructions, helpful in simplifying the understanding of light wave measurement. A copy may be obtained by writing to the Acme Industrial Co., 206 N. Laflin St., Chicago, Ill. **59-A**

CARBURIZING GEARS IN THE ELECTRIC SALT BATH FURNACES—a scholarly and highly technical treatment of the subject by Metallurgist William F. Sorenson. The paper deals with the problem of metallurgical *control* coordinated with increased production in the heat treatment of oil hardened gears and axles, as well as carburized gears and parts. Copies are available from the Ajax Electric Co., Inc., Dept. NK, Frankford Ave. at Delaware Ave., Philadelphia, Pa. **68-A**

UP-TO-THE-MINUTE DATA—about the new Marman Clamps is contained in a 6-page, three-color illustrated folder just published by Marman Products Co., 943 W. Redondo Blvd., Inglewood, Calif. The clamps are designed for all types of duct and hose instal-

(Continued on Page 148)

(Continued from Page 147)

lations, those using hot or cold gases or fluids under either low or high pressure. Included with the folder is a convenient specification sheet and ordering guide. **41-A**

IN AN ATTRACTIVE NEW BOOKLET—entitled "90 Years of Industrial Pioneering", issued by Swan-Finch Oil Corp., R.C.A. Bldg., W., New York, N. Y., the story of the progress in the development of lubricating oils and facts about their role in winning the war are interestingly presented. The importance of lubricants in the aviation and automotive industries is emphasized. Many of the old industrial prints reproduced in the booklet will be of interest to collectors. Copies will be sent upon request on firm letterhead. Address Dept. J-M. **17-A**

AMERICAN AUTOMATIC TYPEWRITER CO.—617 N. Carpenter St., Chicago, Ill., has issued Bulletin 10, describing its new bellows-type vacuum pumps. Designed for production and laboratory applications, the pumps are available in three standard sizes. The bulletin describes construction features, and gives a table of specifications for each model. **18-A**

A CONCISE STORY OF THE NEW PROCESS of tube spinning, recently developed by the Wolverine Tube Division of the Calumet & Hecla Consolidated Copper Co., 1415 Central Ave., Detroit, Mich., is told in a brochure just released by the manufacturer. The brochure is profusely illustrated with photographs of many of the varied shapes that have been made and contains drawings showing comparisons between the old and new methods. The company will send a copy of the booklet (identified as Catalog E-1) to anyone requesting it on company stationery. **19-A**

Proportioned Production
We are helping our customers increase production, by scheduling as to time and in proportion to possible use, our production of precision instruments and tools for them.
Initial shipment may be as little as 10% of the order, but it will cover immediate needs. Then, just in advance of a known increase in our customer's volume, we produce and ship in proportion. Thousands of man- and machine-hours saved, and
our usefulness to war-winning industry increased, with proportioned production of 33 diversified types of gages; also jigs, fixtures and form tools.
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PRECISION
AUTHENTICATORS
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ELECTRIX
Corporation
Peace-time engineers of soft-rubber connectors for electrically-operated equipment
150 MIDDLE ST., PAWTUCKET, R. I.

A CONDENSED CATALOG AND ENGINEERING DATA BOOKLET—released by the Arklay S. Richards Co., Inc., 73 Winchester St., Newton Highlands, Mass., is intended to help the pyrometer user to order quickly and easily the correct material for his own plant conditions. The company makes a complete line of standardized industrial thermocouples, their parts, assemblies, and accessories for pyrometers. **42-A**

METAL DUPLICATING WITHOUT DIES—with Di-Acro Shears, Benders and Brakes is explained and described in a complete 32-page catalog, available from the O'Neil-Irwin Mfg. Co., Dept. T, Minneapolis, Minn. This interesting, economical, time-saving method promises accuracy to .001". **20-A**

(Cont'd on Page 150)

Courtesy Bell Aircraft Corp.

Tips on finishing transparent plastics

THE aircraft manufacturing industries face special problems today in the finishing of transparent plastics. Therefore, an understanding of the abrasive products and methods of use best suited to their solution is important.

The picture above shows a process employed by Bell Aircraft Corporation using a Carborundum Brand Silicon Carbide cloth sleeve to finish the edges of enclosure sections for Airacobra cockpits. Abrasive discs, sleeves, belts and sheets are all widely used throughout the aircraft industry to meet the various finishing conditions encountered.

For best results in most edging operations, sanders should be operated at about 3,000 feet per minute. In general it is better to use a wet sanding process than a dry, in order to reduce heat, settle dust, eliminate loading of the abrasive surface, speed cutting and increase abrasive life. For surface finishing it is well to select as fine an abrasive as possible. One just fine enough to remove any scratches left by the previous operation is usually the right choice. This is a typical example of an operation employed on one of the newer materials of construction. In metal finishing operations, Aloxite Brand Aluminum Oxide in its various forms—discs, sleeves, belts and sheets—is used extensively.

Whatever may be your use of abrasives, we ask you to remember one thing: every abrasive tool is a "Weapon for Production"; it's important to use it wisely.

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THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

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MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company)

(Continued from Page 148)

WITH HIGH PRODUCTION THE NEED OF THE DAY—manufacturers will be interested in the new Davis & Thomas "Victory" production bulletin. It gives pictures and detailed descriptions of the various types of machine tools made by the company. Available upon request to Davis & Thomas Co., 6616 W. Mitchell St., Milwaukee, Wis. **21-A**

ARTER PRESENTS ITS—Model A and Model B Rotary Surface Grinders in two new folders. The complete, detailed descriptions of the two machines should prove helpful to prospective buyers. The bulletins are available on request to the Arter Grinding Machine Co., 16 Sagamore Rd., Worcester, Mass. **22-A**

A SERIES OF FOUR BULLETINS—fully illustrating and describing Sellers Drill Grinders may be had from William Sellers & Co., Inc., 1606 Hamilton St., Philadelphia, Pa. The machines, according to the manufacturer, will increase production, reduce overhead and direct labor, lower assembly costs, save power, lengthen drill life, increase holes per grind, reduce drill inventory and salvage drills, ordinarily scrapped. **23-A**

MORE MINUTES PER HOURS—are offered by The Lodge & Shipley Machine Tool Co., Cincinnati, O., to users of their No. 3A Duomatic Lathe. A comprehensive new booklet covers the important features. It includes diagrams illustrating the wide range of cycles obtainable on either front or rear carriage and tool slide of the machine. For your copy, Address Dept. K. **46-A**

SHEFFIELD GAGES—are described in an attractive, comprehensive new booklet that will be helpful to engineers, production men, chief inspectors and purchasing agents. Covered are the visual gage, Internalgage, Electrichek, Precisionaire, Multichek, Precisionaire Electrichek, Universal measuring instruments, lead measuring instrument, and Sheffield Nitrigages. Copies of the booklet may be had from The Sheffield Corp., Gage Division, Dept. T-D, Dayton, O. **24-A**

DATA SHEETS—on the performance of Tantung tools and cutters are compiled in a 46-page loose-leaf type booklet. The information contained in the sheets is from special reports of field representatives for Tantung tools. Reports selected for this presentation were intended to show a cross section of the application of Tantung and what is being accomplished on a variety of representative machining operations. Copies available from the Vascoloy-Ramet Corp., Dept. D, N. Chicago, Ill. **25-A**

(Cont'd on Page 152)

WALTHAM GAUGES

★ **SPLINE & INVOLUTE** ★

★ **GAUGES A SPECIALTY** ★

★ We manufacture all types of precision limit gauges. Either standard or specially built to your requirements. Fast, dependable service. Finest craftsmanship. ★

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- HIGHER SPEEDS
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The New Centrifugally Cast Cutting Alloy Containing BORON

GRADE V: For heavy roughing on all types of high tensile strength materials (1/32" to 1/8" feed)
Rockwell "C" hardness 61-63

GRADE X: For medium roughing and semi-finish on all high tensile strength materials (.010" to .032" feed)
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GRADE XV: For finishing cuts on all types of materials. Also roughing and semi-finish on low tensile strength materials such as bakelite, brass, bronze, aluminum, copper, etc.
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RECOMMENDED SPEED INCREASES OVER HIGH SPEED STEEL:

Low tensile strength materials	100% to 300%
Cast iron and semi-steel	100% to 300%
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KUTKOST SOLID TOOL BIT PRICE LIST (*Now ready for delivery*)

Size	Price Each	Size	Price Each	Size	Price Each
¼ x ¼ x 2¼	$ .95	⅜ x ⅜ x 3	$1.65	½ x ½ x 4	$3.25
5/16 x 5/16 x 2½	1.25	7/16 x 7/16 x 3½	2.40	⅝ x ⅝ x 4	4.70

GENERAL TOOL AND DIE CORP.
553 PROSPECT ST. EAST ORANGE, N. J.

(Continued from Page 150)

GIDDINGS & LEWIS MACHINE TOOL CO.—of Fond du Lac, Wis., presents a condensed catalog of their equipment in an endeavor to place in the hand of all users of Horizontal Boring, Drilling and Milling Machines a resume of some of the principal features and the major specifications of the wide range of Giddings & Lewis machines and accessories. Copies available. **43-A**

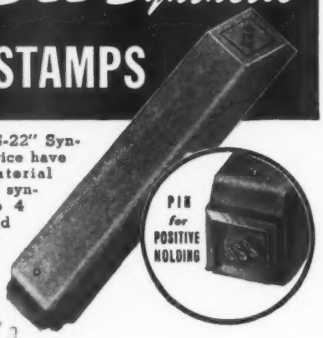
TO ASSIST BROACH USERS—in increasing the efficiency of broaching set-ups and in conserving vital tools, Colonial Broach Co., P.O. Box 37, Harper Station, Detroit, Mich., has prepared a poster-folder that answers questions frequently asked regarding broach use. Suitable for wall mounting, the poster measures 17" x 11". Request Bulletin 290, from the company. **26-A**

ADVICE TO FABRICATORS OF ENDURO STAINLESS STEEL—is offered in a new booklet just published by Republic Steel. Because of its high strength and variety of finish, care must be exercised in fabricating Enduro. With proper equipment and adherence to the instructions in this booklet, however, fabricators should experience no difficulty, according to the manufacturer. For your copy, write to Republic Steel, Dept. T-D, Cleveland, O. **27-A**

HOW LOVEJOY MILLING CUTTERS—meet the requirements of modern production methods is outlined in a new catalog that will be of interest to superintendents, engineers, and purchasing agents. All blades are interchangeable in Lovejoy cutters, eliminating special fitting when replacement becomes necessary. For your copy, write to Lovejoy Tool Co., Inc., Dept. J, Springfield, Vt. **28-A**

Amazing S-22 Synthetic

ETCHING STAMPS



Thousands of our new "S-22" Synthetic stamps now in service have proved that this new material outlasts rubber or other synthetics by from 3 to 4 times, when used with acid etching inks. Order "S-22" next time you need inspection stamps.

INSPECTOR'S KIT

Made of acid proof, non-critical material, this new Kit holds stamps, etching ink, ink pad and neutralizer. Inexpensive, compact and convenient. Write for quotation.

Write for Bulletin S--Catalog 146

This valuable bulletin illustrates the various styles of stamps available. Write for your copy today.

JAS. H. MATTHEWS & CO.

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Branch Plants

New York, Boston, Chicago, Philadelphia, Newark, Syracuse

District Sales Offices

Cleveland Detroit Hartford Birmingham

"SWARTZ TOOL PRODUCTS CO.'S NEW CATALOG—deals with their lock and fixture equipment, and includes all the information required by the designer and engineer. Diagrams, specifications and data sheets make ordering easy. Copies available from the company at 13333 Foley Ave., Detroit, Mich. **29-A**

"YOUR DRILL PRESS IS A GOOD TAPPING MACHINE" — declares the Ettco Tool Co., Inc., 597 Johnson Ave., Brooklyn, N. Y., in their new catalog describing their high speed, sensitive, friction clutch tapping attachment. Included in the folder is a helpful article by G. W. Emrick, president of the

(Cont'd on Page 154)

FOR DEFINITE DELIVERY DATES ON TURNER GAUGES..

SEND FOR THIS BULLETIN TODAY!

IT GIVES YOU UP-TO-THE-MINUTE PRODUCTION DATES ON:

PLUG • RING • SNAP • FLUSH PIN • BUILT UP •

Because all trade journal advertisements have to be prepared 30 days before publication date, it is impossible for the Turner Gauge Grinding Company to publish accurate delivery dates in their advertisements. That is the reason why Turner asks you to write for the "Turner Bulletin" which is issued each month just after the publications are sent out. In this way, Turner is able to check their latest production schedules, so that they can give you up-to-the-minute delivery dates on their gauges, thereby assuring you of definite deliveries.

IMPORTANT

Let us put you on our mailing list so that you will be sure to receive this important bulletin each month. Send your name today!

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY
2024 HILTON ROAD • • • • FERNDALE, MICH.

(Continued from Page 152)

company, on "How to Overcome Some Tapping Troubles". **30-A**

TITEFLEX METAL HOSE CO.—has just released a new catalog, No. 113, which deals with the general industrial applications of their line of flexible metallic tubing for conveyance of oils, gases and liquids. Complete data is given on available fittings, both industrial and S.A.E. Also included are complete pressure charts, charts showing radius of bend, and other essential information. Of interest particularly to design engineers, power engineers, maintenance executives and production executives, the catalog is available on request to the Titeflex Metal Hose Co., 505 Frelinghuysen Ave., Newark, N. J. **31-A**

TWO NEW 4-PAGE CATALOGS—one describing Hydraulic Power Units and the other, Hydraulic Test Units, have just been published by Hydraulic Machinery, Inc., 12828 Ford Rd., Dearborn, Mich. The power unit section shows ten different models, typical of what can be used in conjunction with new machines or for change-over to hydraulics. The test unit section shows a few of the models that have been built "for checking hydraulics before and after assembly," including a portable unit that may also be equipped with a gasoline-engine-driven pump for field testing. **32-A**

McKENNA METALS CO.—500 Lloyd Ave., Latrobe, Pa., announces a new descriptive catalog, concerned exclusively with milling metals with cemented carbides. The new catalog, describing Grayson-Kennametal milling cutters and applications, is entitled, "Specialized Milling with Grayson-Kennametal Milling Cutters." Copies available on request. **33-A**

A CUTAWAY, SECTIONAL VIEW—of the automatic machine tool control, manufactured by the Detroit Universal Duplicator Co., is shown in a new 16-page leaflet, entitled "What is Duplimatic and How Does It Work?" Available without cost to executives in charge of tooling, production, etc., the folder shows how the Duplimatic provides automatic control to put intricate milling, turning, boring, shaping, die sinking and similar operations on a high speed production basis, by means of a simple method of converting variations in electrical impulses into hydraulic motion. For your copy, address the Detroit Universal Duplicator Co., Dept. T-D, 751 E. Milwaukee Ave., Detroit, Mich. **34-A**

MOT-O-TROL—an electronic adjustable-speed drive which provides wide stepless range, automatic speed regulation and smooth, fast acceleration with automatic current limitation is described in a new 4-page

(Cont'd on Page 156)

Flame Hardening · Annealing · Aerocasing
Bar Stock Treating and Straightening
Heat Treating · Pack or Gas Carburizing
Sand Blasting · Chapmanizing · Tempering
Cyaniding · Nitriding · Hi-Speed Hardening

METAL TREATING INSTITUTE

THE LAKESIDE STEEL IMPROVEMENT CO.
5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

HOW GORTON saves time ON PROFILE MILLING WITH SEMI-SKILLED OPERATOR

GORTON

9-J Super-Speed Vertical Mill with Duplicator Table and Tracer Profiles Crankshaft Part in 15 Minutes Floor-to-Floor Time

● This prominent airplane engine manufacturer (name on request) utilizes semi-skilled help for operating Gorton Super-Speed Milling Machines and Duplicators. The operation being performed is *Profile Milling of a .738" Radius on the Rear Section of a Steel Crankshaft.* Feed is by hand, spindle speed is 500 r.p.m. using a special .738" diameter four-fluted ball cutter. (This cutter is ground on a Gorton 375-2 Cutter Grinder.)

This is an excellent example of the ease of operation of Gorton High-Speed Millers and Duplicators in performing unusual operations.

AN EASTERN MANUFACTURER OF TOOLS AND DIES WRITES: "...MOST IMPORTANT TODAY IS THE FACT THAT WE CAN USE WOMEN TO OPERATE THESE MACHINES."

SUPER-SPEED MILLING DATA

OPERATION—Profile Mill .738" Radius.

MACHINE—Gorton 9-J Super-Speed Vertical Mill with Duplicator Table and Tracer.

PART—Rear of Crankshaft—Steel.

CUTTER—Special .738" dia. Ball Cutter—Profile Form Type—4 Flute.

HOLDING—Special Fixture.

FEED—Hand.

SPINDLE SPEED—500 r.p.m.

STOCK REMOVED—1/8".

FLOOR-TO-FLOOR TIME—15 Minutes.

FREE

Additional data and specifications are included in this booklet. Write for your copy today. Ask for Catalog No. 1400-B.

These are but two of many ways in which Gorton Super-Speed Milling Machines are saving vital man hours on form milling.

Perhaps you, too, can save additional hours on your present or new milling equipment. Gorton Engineers, specialists in Vertical High-Speed Milling, will be glad to make recommendations on your work—without obligation.

GEORGE GORTON MACHINE CO.

1319 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

(Continued from Page 154)

illustrated booklet announced by Westinghouse Electric and Mfg. Co., Dept. V, East Pittsburgh, Pa. **35-A**

THE QUICK ACTION AND ACCURACY—of Automatic Stub Lathes are stressed in a booklet issued by the Sundstrand Machine Tool Co., 2547 Eleventh St., Rockford, Ill. For full details, suggestions on specific uses or tooling and quotations, write directly to the company. **36-A**

DECREASE OF OPERATOR FATIGUE—and improvement of machine performance has been credited to the installations of Torqqua-matic transmissions, as described in Bulletin No. 4 SG-1, issued by the Torq Electric Mfg. Co., Cleveland, O. **45-A**

AMERICAN PACEMAKER LATHES—are discussed and illustrated in Bulletin 15-J, issued by The American Tool Wks. Co., Cincinnati, O. These lathes have selective speeds; it is impossible to simultaneously engage conflicting gear runs. Only short, stub shafts, all mounted on anti-friction bearings, are used in the head conflicting gear runs. **37-A**

BRUSH SPRINGS—made by the Instrument Specialties Co., Inc., Little Falls, N. J., are described in Bulletin No. 5-D. Part I is written for the user of brush springs, while Part 2 is addressed to the designer, and includes data and formulae for designing "Micro-processed" brush springs for longer brush life. **38-A**

SUPER GRINDING—is the title of a 43-page pamphlet issued by the Hill-Clarke Machinery Co., 646 Washington Blvd., Chicago, Ill. Super grinding, a very fine grinding that produces a micro-finish surface, can be done with a coarse grain wheel on a Hill-Clarke machine. The new booklet tells how and why. **39-A**

TWO SPINDLE
Adjustable
DRILL HEADS
Drill Two Holes At Once

✓ *Adjustable Centers from ½" to 6"*

✓ *Drill Capacity 0 to 5/8"*

Sleeve and overarm types . . . in several sizes. Will double output of any single spindle drill press.

Quickly adjusted to desired drill centers from ½" to 6".

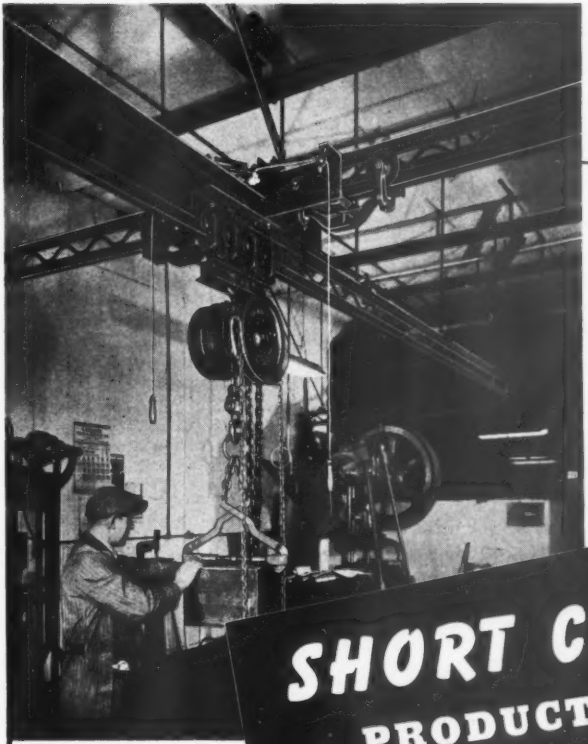
Send for bulletin.

LINDERME MACHINE & TOOL CO., INC.
12250 COYLE AVE., DETROIT 27, MICH.

INFORMATION ON BROACH SAWS—made of high speed steel can be had by writing to the Diamond Saw Works, Dept. T, Buffalo, N. Y. If you are interested in easier, faster and more economical cutting, send for descriptive literature. **40-A**

TO HELP TRAIN INSPECTORS AND MACHINISTS—in the use of gage blocks and vernier instruments, the Jansson Gage Co., 19212 Glendale Ave., Detroit, Mich., has issued a "Handbook of Precision Measurement". It covers the history of measurement, precision measurement, making gage block combinations, gage block inspection, angle measurement with the sine bar, and the use and reading of vernier calipers and height gages. Offered to individuals at a price of fifty cents, a complimentary copy of the booklet is available to executives requesting it on their company letterheads. **1-A**

(Cont'd on Page 158)



Die blocks move easily off crane over interlock on short track to press.

SHORT CUT TO PRODUCTION

Every American MonoRail Overhead Handling System must be "made to order", and yet, these "tailor-made" systems are made from standard parts. Because of its extreme flexibility, American MonoRail offers a wide range of application without costly adjustment or lengthy engineering. See an American Mono-Rail Engineer today.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations

THE AMERICAN MONORAIL CO.

13131 Athens Avenue — Cleveland, Ohio

★

(Continued from Page 156)

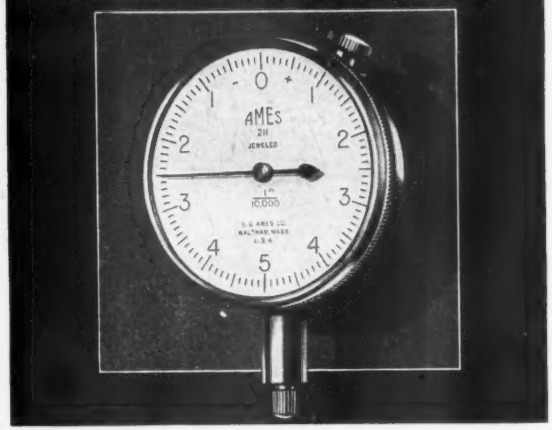
AIDING WAR PRODUCTION WITH CLEAN DRY AIR—is the title of a new 8-page bulletin just released by the Logan Engineering Co., 4908 Lawrence Ave., Chicago, Ill. It points out the unnecessarily high maintenance and replacement costs and loss in man-hours resulting from moisture and dirt in compressed air lines. The bulletin also describes the Logan Aridifier, designed for cleaning and drying compressed air. Request Bulletin 543 from the company. **2-A**

COPIES ANYTHING WRITTEN, PRINTED OR DRAWN—is the claim made for their APeCO machine in a new folder just put out by the American Photocopy Equipment Co., 2849 N. Clark St., Dept. AA-3, Chicago, Ill. The low price of the machine is an appealing factor for companies who want speedily-reproduced photo copies of letters, forms, blueprints, drawings, photographs, etc., without investing in heavy or expensive equipment—or in machines that may require special skill. **3-A**

CROWN GEAR MOVEMENT, JEWEL BEARINGS, INDEX POINT—and reversible point, plus adaptability and accuracy are features of the new Federal Products Testmaster universal dial indicator. Furnished in two models, the Testmaster is described in a new bulletin. One model is graduated in .001" and the other in .0001". Both have the same size dial. For further information, address the Federal Products Corp., 1145 Eddy St., Providence, R. I. **4-A**

TATRA TOOL CO.—16318 Sanford Ave., Cleveland, O., has issued a new booklet describing their various type angle plates, boring mill angles, surface plates, pattern makers and hobby shop layout plates. Detailed descriptions, size specifications, prices and illustrations are included. **5-A**

AMEs *Hundred Series*
DIAL INDICATORS



Made to A. G. D. specifications in four sizes with fourteen different dial numberings indicating thousandths, half and tenths of thousandths inches. Plain or jewel bearings. Shock absorbers for all models.
Send for new catalog No. 52

B. C. AMES CO., WALTHAM, MASS.

RECO DAYLIGHT COLOR HOODS—filter out the harmful red and yellow rays from the white light of electric bulbs, according to a new bulletin just issued by the Reynolds Electric Co., 2656 W. Congress St., Chicago, Ill., manufacturers of the hoods. Recommended for war industries to reduce workers' eye fatigue, strengthen vision, cut down on accidents and speed up production. **6-A**

ACCORDING TO A NEW CIRCULAR—with the Universal 3-way angle-set vise you can slash setup time, modernize single-purpose machines, step up production with standard tools and put discarded machines back to work. For your copy, write to the Universal Vise & Tool Co., Dept. T, Parma, Mich. **7-A**

SPEED UP BENCH LATHE PRODUCTION—with the Recor lever collet closer, as described in a new bulletin put out by the Recor Mfg. Corp., 432 S. Green St., Chicago,

(Cont'd on Page 160)

Tannewitz DI-SAWS

have LARGER CAPACITY, saw *Easier*, STRAIGHTER

In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

(Continued from Page 158)

Ill. The new collet closer permits feeding and releasing of bar stock through the collet without stopping the lathe. Ten-day delivery guaranteed. **8-A**

THE METRO TOOL AND GAGE CO.—4242 Peterson Ave., Chicago, Ill., presents a new catalog to their customers in an endeavor not only to show the prices of their standard products, but also to present engineering data that will be helpful in selecting the proper tool or gage for every purpose. Copies are available on request.. **9-A**

THE USES AND ADVANTAGES OF AIR-HARDENING DIE STEEL FOR HIGH PRODUCTION—are covered in a new Firth-Sterling bulletin. Characteristics of Cromoco, general applications, special applications, heat treatment, pack hardening, air-hardening and expansion properties of the metal are discussed. Request your copy from the Firth-Sterling Steel Co., Dept. T-D, McKeesport, Pa. **10-A**

ACTUAL SIZE ILLUSTRATIONS—of Graham hand cut rotary files appear in a new loose-leaf type bulletin. For further information about these files, available in any size or shape specified by the customer, request a copy from the Graham Rotary File & Tool Co., 387 Fourth Ave., Dept. TD, New York, N. Y. **11-A**

SPECIFICATIONS AND BRIEF DESCRIPTIONS—of significant features of the Modern Cam Vise and the Modern Swivel Vise are contained in an illustrated one-page folder. Copies available on request to Modern Tools, Dept. D, East Berlin, Conn. **12-A**

BRIDGEPORT TURRET MILLING MACHINES—can be converted to jig borers with the new vernier attachment, described in a new bulletin published by the Nichol Machinery Co., 633 N. 7th St., Milwaukee, Wis. A blueprint drawing and engineering data are included. **13-A**

THE LATEST DESCRIPTIVE LITERATURE—on the Porter-Cable model G-8 wet-dry surfacer is available on request. This model is especially useful on flat, precision work, and for squaring operations. It may be used on metals, plastics, rubber, glass, or ceramics. Address the Porter-Cable Machine Co., Dept. T, Syracuse, N. Y. **14-A**

SAV-WAY PRESENTS A COMPLETE SET—of standard plug gages for hole inspection, set in increments of 1/64ths, starting at ¼" and going to 1". The set, consisting of 144 plugs and 4 handles, is encased in a clear-view, loss preventive, transparent plastic case. Full details are given in a new bulletin. Write to Sav-Way Industries, 4877 E. Eight Mile, Detroit, Mich. **16-A**

(Cont'd on Page 162)

ARE YOU
CLEAN OIL CONSCIOUS
DO YOU KNOW that it is possible to completely remove all abrasives, dirt and contamination from oils and coolants used in cutting, grinding, honing, thread cutting and similar operations?
Do you know that the removal of this contamination will increase production, lower costs and remove all danger of Dermatitis?
Honan-Crane Oil Purification equipment will continuously remove these contaminants as fast as they are liberated and your machines operate at all times on clean fresh oil.
The complete, continuous removal of this contamination will:
1. Allow better finish of products
2. Lengthen tool life
3. Reduce time lost in grinding tools and dressing stones
4. Cut rejections to a minimum
5. Prevent loaded stones from affecting final finishes
6. Prevent Dermatitis
7. Safely extend life of oil or coolant
Write for complete information on any type of oil.
Honan-Crane
801 WABASH AVE.
LEBANON, INDIANA

DOUGLAS *Precision* MACHINES

The Douglas Miller combines rigid, well balanced design with convenience of control making it particularly suitable for accurate work in tool room as well as for general production. It is available in plain or universal type.

Showing operation with Universal Milling attachment on tool room job producing a production fixture.

Showing operation with four cutters machining alloy steel for high precision aircraft parts

FOR TOOL ROOM AND PRODUCTION

Prompt Delivery to War Plants

The Rotorex Universal Tool and Cutter Grinder will accurately perform all kinds of tool grinding operations. Readily interchangeable attachments are available to set up machine for single-purpose jobs such as cylindrical, internal and radius grinding.

Operation showing set-up for internal grinding.

Operation showing set-up for sharpening straight gash hobs.

DOUGLAS MACHINERY CO., Inc.

150 BROADWAY • NEW YORK, N. Y.

(Continued from Page 160)

FOR CONVENIENCE IN ORDERING—The O K Tool Co., Inc., Shelton, Conn., has published a 78-page catalog with detailed descriptions of their wide variety of single point tools. Separate folders are available on the O K T-slot bolts and the O K adjustable shankless serrated holders and tool bits. **15-A**

MEEHANITE SURFACE PLATES, ANGLE PLATES—straight edges, box parallels, flat parallels, universal right angles, toolmakers' knees and lapping plates made by the Acme Tool Co., 206 Church St., New York, N. Y., are described in a new folder. Included is an interesting section on the properties of Meehanite. Copies upon request. **69-A**

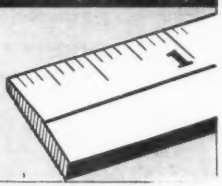
HOW TAPS ARE USED AND ABUSED—the kinds of taps, the thread form, and the parts of a tap are all covered in an informative booklet published by the Threadwell Tap and Die Co. for distributors. The last section of the book is devoted to specific suggestions on how to sell Threadwell taps. Address the company, Dept. T, Greenfield, Mass. **70-A**

FIVE STATION LATHE TURRETS—manufactured by the Automatic Machine and Tool Co., 135 Charles St., Auburndale, Mass., are described in a new catalog which claims they will save on tool bits, cut costs, increase production and enable you to get more out of your engine lathe. **71-A**

WHEELCO'S NEW CATALOG—provides the prospective buyer with a convenient, condensed listing, with current prices and short descriptions, of the principal equipment manufactured by the company. This and other bulletins covering specific instruments in detail are available from Wheelco Instruments Co., Dept. L, Harrison and Peoria Sts., Chicago, Ill. **72-A**

Imagine dividing an inch into
TWO HUNDRED THOUSANDTHS (0.00002)

That's the ACCURACY, ±
OF A



DUBLIFE

Reversible PLUG GAGE

with TWO lives

Only experienced gage specialists with finest equipment can insure such precision. To this United *adds another life to the gage.* Each end, "Go" and "No Go" reversible. Turn either end when worn and you have a new gage. Plugs locked by bronze split collet in one handle. UPPCO lapped enduring finish. Sizes: .030 to 1".

Send for Catalog showing line with complete Engineering Data.

Also other gages of American Gage Design.

Write

UNITED PRECISION PRODUCTS CO.

3516 WEST BELMONT AVE. CHICAGO, ILL.

FOUR CONVENIENT CATALOGS — published by Pyott make ordering their products greatly simplified. The largest of the four is on Pyott Vee-tex drives. It is a thoroughly complete V-belt guide and serves well as a standard reference book. Besides price information, specifications and illustrations, considerable engineering data and important mathematical tables are included. The other three catalogs cover (1) Pyott pulleys, (2) gears and (3) sprockets and roller chains. For copies, write to Pyott Foundry & Machine Co., 331 N. Sanganon St., Chicago,, Ill. **73-A**

TO HELP YOU GET THE MOST—from your projection measuring equipment, The Universal Engraving & Colorplate Co., 1923 E. 19 St., Cleveland, O., has published a handy pocket size manual on their engineer's glass and transparencies. Copies available on request. **74-A**

SAVE PRODUCTION TIME
with a SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 57" above floor and lowers to within 8¼" of floor. Overall height 72". Size of platform 24"x24" steel plate. Crank, up and down, hoist unit.

ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago

Price **$147.50**

IMMEDIATE DELIVERY

INDUSTRIAL DIGEST

(Continued from Page 135)

WPB Ruling Simplifies Tools

Part of a general program to simplify tools, the new Schedule 4 of Limitation Order L-216 has reduced the number of sizes in which rotary files can be produced from 380 to 70. In issuing the order, War Production Board officials stated that the large size files can be reground from twenty to thirty times, and urged such regrinding whenever possible.

Sizes and shapes in which rotary files may be manufactured are also specified. However, producers may apply for permission to devote up to 10% of their output to special cutting tools which do not conform to the specifications.

Employees Loan Tools

News of an outstanding example of labor joining forces with industry for the winning of the war was received from General Electric's Pittsfield Works. When production requirements created an unexpected heavy demand for drills, taps, reamers, saws and miscellaneous tools, maintenance department workmen loaned the Company a total of 992 small tools from their own chests, augmenting a salvage and reclamation program which averted an emergency.

The personal tool chest collection was in response to an explanation of the situation by the maintenance department foremen who promised the tools would be replaced as soon as the Company could obtain new ones. Among the tools contributed by the men were straight and taper shank drills, taps and reamers, with a total value of $1198, all fit for immediate use.

(Cont'd on Page 166)

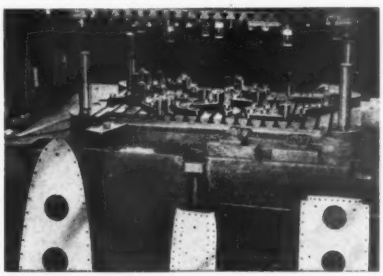
ZAGAR INVITES YOU...
Have you perchance a small broaching job that simply will not yield gracefully to oversize broaching equipment? Please give us the details. Maybe we will be able to supply an answer with our . . . .
New ZAGAR HORIZONTAL BROACHING MACHINE
. . . shortly to be announced. Meanwhile, Zagar invites you to lay your broaching problems before our engineering department.
←Milling spring slots in collet with 2" Zagar Indexing Fixture, indexing 3 times at 120°. Part held very rigid. Set-up extremely simple. Performance trouble-free. Job would run on U.S. hand mill. Production: 54 milled slots per hour when using tool steel.
Zagar Indexing and Holding Fixtures short-cut production, save time and make more money
Ask for Our Bulletin "D-7"
COLLETS
In stock — Zagar No. 2 and No. 6 Collets, similar to W. & S. No. 2 and No. 6 Collets.
ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio

YOU COULDN'T ASK FOR ANYTHING MORE SIMPLE — OR BETTER THAN

WHISTLER ADJUSTABLE PUNCH and DIE UNITS

Whistler Adjustable Dies work on any type press and because of their simplicity even new workers quickly learn to make pattern change-overs—increasing productive press hours. Absolute precision on short or long runs. Whistler design permits more perforations in a given area—often reducing press operations.

For quick and complete information on the advantages of Whistler Adjustable perforating and notching dies send a description or drawing of your work.



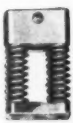
These pieces produced with Whistler Adjustable Dies clearly illustrate the re-use of same punch and die units.

These photographs show the simplicity of a Whistler Adjustable Punch and Die assembly. Every piece is interchangeable.

Self-locking bolts on punch holder drop into T slots of die shoe. Set-screw engages into recess at base of punch. Punch cannot turn or pull out in operation.

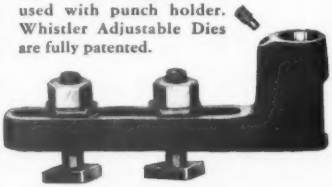
Punches of finest tool steel are machined to .0001" tolerances.

Stripper unit fits smoothly over punch—no "wobble". Flushed set-screw engages into groove on punch body. Stripper or punch quickly removed when desired.



Grooved heads on dies make lifting from holder quick and easy. Like the punches, dies are held firmly into holder by set-screw in recess at base. Whistler *precision* is known the world over.

Die holder has self-cleaning slug chute. Special design bolt heads present two bearing surfaces to T slot channel—self-locking, same as used with punch holder. Whistler Adjustable Dies are fully patented.



Write for the Whistler Catalog—every Production Executive should have it.

S. B. WHISTLER & SONS, Inc.

Over 25 Years of Tool and Die Making Experience

752-756 MILITARY ROAD BUFFALO, N. Y.

INDUSTRIAL DIGEST

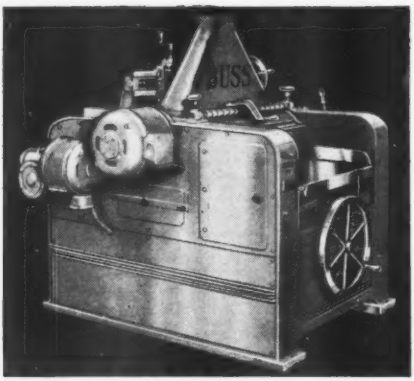
(Continued from Page 164)

OWI Surveys Small Plants

Fifty-eight percent of the nation's small manufacturing concerns (those employing no more than 125 wage earners) are engaged directly or indirectly in war production, according to a survey made by the Office of War Information. Of the remaining 42%, about one-quarter have been unable to get war production contracts and about three-quarters have not tried to get war contracts because their products were not required for war, because they had enough civilian business or for other reasons.

The two major problems confronting all manufacturers included in the survey were labor and materials. Sixty-three percent complained about not getting enough labor, and 62% said it was difficult to get enough materials. Lack of war orders represented a poor third to labor and materials, being mentioned as a primary problem by only 19%.

BUSS *Wood Surfacers*



GIVE YOU THE ABSOLUTE PRECISION ESSENTIAL IN PATTERN AND JIG MAKING!

—plus faster change-over, greater convenience of operation and the assurance of years of perfect service. Write for Bulletins Type 4-L showing the many patented features which make this the finest of all surfacers for pattern and jig departments. Production Models to suit every circumstance. We specialize in surfacers.

BUSS MACHINE WORKS
214 EIGHTH ST. HOLLAND, MICH.

Four-Acre Blackout Plant

To augment the already large output of the Radio Division of Westinghouse, a new four-acre blackout plant has been opened on the East Coast for the production of special type radio equipment for the Army. Designed to conserve critical materials, the new plant used 1,554,000 board feet of lumber, at an estimated saving of 1,920 tons of steel. It required the use of more than one acre of pressed wood panels in place of window glass.

Light and ventilation are carefully controlled in the building which contains nearly two

(Cont'd on Page 168)

TO PLANT OFFICIALS CONCERNED WITH INCREASING WAR PRODUCTION...

SEND FOR YOUR COPY OF OUR NEW ILLUSTRATED CATALOG GIVING

LATEST *Complete* INFORMATION ON PRECISION GAGES, FIXTURES, JIGS and DIES...

We invite you to have this valuable handbook at your fingertips for ready reference on our entire line of Quality Precision Gages, including details about our COMPLETE GAGING SYSTEM FOR CARTRIDGE CASE INSPECTION. We believe you will find this catalog extremely helpful in your endeavor to expedite production of essential war materiel. Fill in the coupon below and . . . . . MAIL TODAY

QUALITY TOOL & DIE CO.
Manufacturers of Quality Products
INDIANAPOLIS, INDIANA

QUALITY TOOL & DIE CO.
N. Noble & E. Vermont, Indianapolis, Ind.
Gentlemen:
Please send me a copy of your new illustrated catalog of Precision Gages, Jigs, Fixtures and Dies—Without obligation to me.

Firm Name.....

Address.....

Your Name.....Title.....

INDUSTRIAL DIGEST

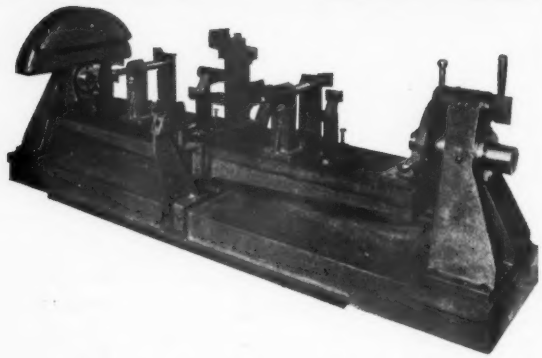
(Continued from Page 166)

miles of tubular fluorescent lamps to simulate daylight working conditions. Huge electric fans effect a complete change of air every fifteen minutes. Westinghouse will operate the factory for the Defense Plant Corporation.

Industrial Standards in Latin America

The American Standards Association has opened a Field Office in South America and established a backstop Inter-American Division in its New York office, with the objective of promoting the use of All American Engineering and Industrial Standards in the Latin American Nations. Under this program the Association will exchange technical data on the development and use of all standards with the other American nations, give them information on the standardization work being done in the United States, and provide Spanish and Portuguese translations of American Standards. The prime purpose of the program is to provide so thorough an interchange of technical data and information that, as a result, all of the nations of the Western Hemisphere may have standards as much alike as possible.

We Sell Precision . .



★ Dies, Jigs, Fixtures, Special Machinery and Designing.

Hardened and Ground Parts to Order.

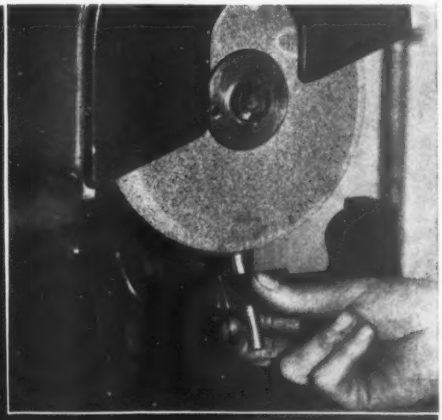
MASTER MACHINE & TOOL COMPANY

925 WEST NORTH AVENUE, CHICAGO, ILL.

Army-Navy "E" Awards

The Army-Navy "E" flag with one star for continued excellence in war production was awarded to the employees of the H. M. Harper Co., 2620 Fletcher St., Chicago, Ill., last month . . . just six months after winning the first "E" award. In making the presentation, Admiral A. M. Charlton, U.S.N., said, "Recently I have been in charge of rehabilitating some of the warships sunk at Pearl Harbor. I am glad to tell you those ships are again in service and they are better than they were before December 7, 1941. In our rebuilding program, we

(Cont'd on Page 170)



DRESS YOUR GRINDING WHEELS

quickly and accurately—save time and improve quality of work with the

"LITTLE WONDER" RADIUS DRESSER

This inexpensive tool will be of use in any grinding room to keep grinding wheels in condition for radius grinding jobs.

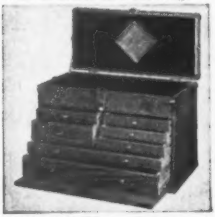
To obtain the desired radius, the diamond tool is set a certain height from bottom or top of the ground flat on the swinging arm. A depth gage, gage block or micrometer may be used for setting.

The "Little Wonder" Radius Dresser will dress radii from 0 to 1" either concave or convex. You can use it for grinding forming tools, fillets, templets and for grinding rake angles on collapsible tap chasers.

Price Complete with Diamond . . $46.00
Immediate Delivery. Order Today!

REED MICROMETERS assure accuracy over full range of screw. Easy to read, smooth and sensitive. 901 Tenths $10.25 List.

MACHINISTS' TOOLS—available in a wide range of types for all kinds of precision measuring.



TOOL CHESTS — lightweight, strong and durable; separate locks for open top and drawer sections. #720 Oak $13.50 Net.

DIAL INDICATORS—fully guaranteed for accuracy. Available with attachments for various uses.

Grinding Room Specialties
MAGNE-BLOX laminated magnetic parallels and V blocks for holding work that cannot be placed directly on magnetic chuck. $14.50.

GEORGE SCHERR COMPANY, INC. 128-G LAFAYETTE ST., NEW YORK, N. Y.

INDUSTRIAL DIGEST

(Continued from Page 168)

have used quantities of Harper non-rusting bolts, nuts, screws and washers."

* * *

Builders Iron Foundry (Builders-Providence, Inc.), Providence, R. I., is another of the large industrial firms to win "for a second time the Army-Navy production award for meritorious services on the production front." Robert P. Patterson, Under Secretary of War, declared at the presentation ceremonies that it was a "symbol of appreciation from our armed forces for continued and determined effort and patriotism."

Industrial Personnel Changes

The Cincinnati Milling Machine Co. recently announced three new executive appointments. Millard Romaine, following a service of two years with the War Production Board in Washington and Dayton, returned to the company to assume his new duties as Assistant to the President. Mr. Romaine was formerly Sales Manager.

Lester F. Nenninger, Engineering Department head, has been named Works Manager, succeeding W. Peaslee who has retired from active service. Mr. Nenninger will be in charge of Engineering Works and Production. Swan E. Bergstrom, formerly manager of the company's Detroit office, and recently Assistant Sales Manager, has been appointed Sales Manager.

* * * *

Edwin B. McConville was elected Treasurer of Skilsaw, Inc., Chicago, Ill., at a recent meeting of the board of directors. Mr. McConville brings to his new position the background of a quarter-century of financial and merchandising experience, having been treasurer of Finch, Van-Slyck and McConville, St. Paul, until he joined Skilsaw as comptroller in 1942.

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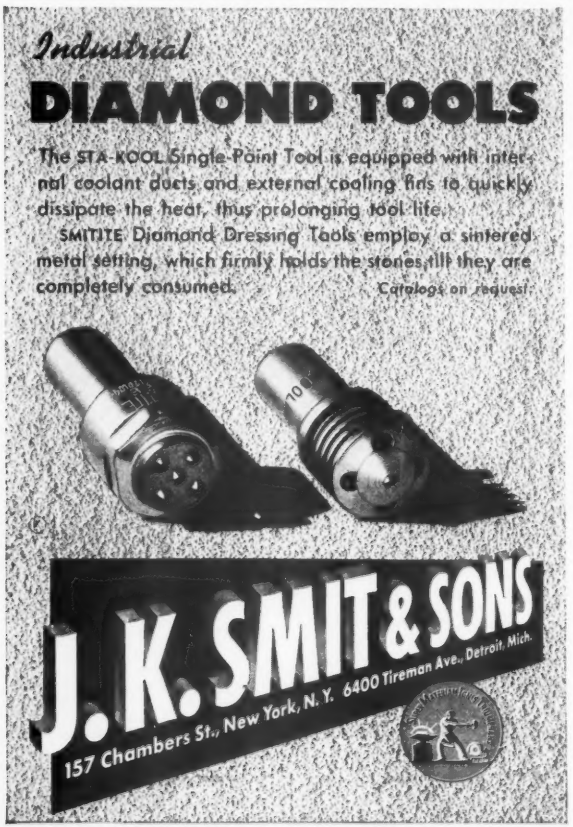
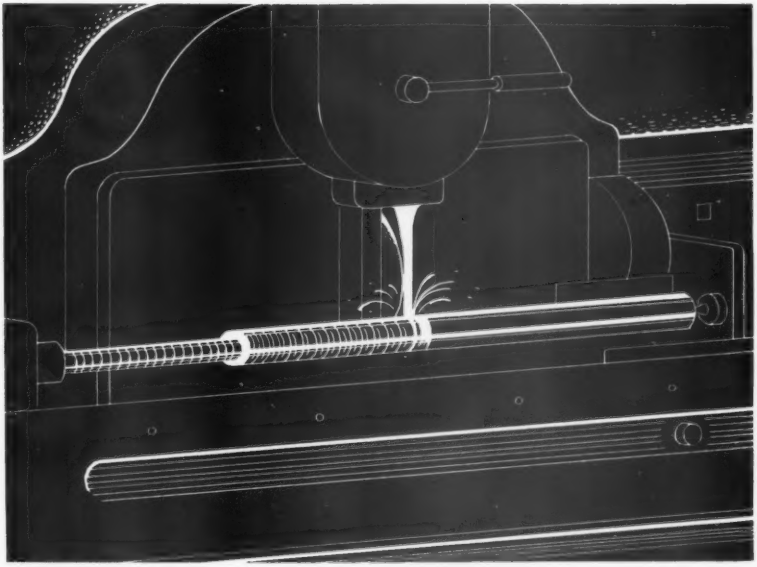

Industrial
DIAMOND TOOLS
The STA-KOOL Single-Point Tool is equipped with internal coolant ducts and external cooling fins to quickly dissipate the heat, thus prolonging tool life.
SMITITE Diamond Dressing Tools employ a sintered metal setting, which firmly holds the stones till they are completely consumed.
Catalogs on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.



GILRON THREAD GRINDING COOLANTS ARE TAILOR MADE!

Aircraft parts, standard and special gages and a myriad of precision specialties to fill our war needs require thread grinding operations.

Gilron engineers have developed an oil (coolant) to materially increase production speed and output of inspector-approved work.

As a tailor-made product it is adjusted to meet the working conditions of each plant according to material ground, finish, grinder and desired speed and feed.

A convincing list of satisfied users testifies to the value of this *new* Gilron development. It will pay you to investigate. Write for data unit T.

Gilron PRODUCTS COMPANY

1557 EAST 40th STREET
CLEVELAND, OHIO

SCIENTIFIC COOLANTS
DRAWING-GRINDING-CUTTING

INDUSTRIAL DIGEST

(Continued from Page 170)

Hugh E. Anderson of the sales department of Honan-Crane Corp. has been appointed General Sales Manager for the Corporation. Mr. Anderson was previously associated for many years with the Packard Motor Co., and more recently as Sales Manager for the Park Chemical Co., Detroit, Mich.

* * * *

Edward Shaw, Sr., formerly New England sales representative for The Producto Machine Co., has joined the Moore Special Tool Co., Bridgeport, Conn., as sales manager, according to R. F. Moore, president. He will have charge of sales of the Moore Jig Borer and the Moore Jig Grinder, precision machine tools, and the tool-and-die division.

* * * *

At a recent meeting of the stockholders of the Kearney & Trecker Corp. five executives were elected to new offices. J. L. Trecker was appointed Executive Vice President. R. W. Burk was made Vice President in charge of Sales; E. W. Trecker, Vice President in charge of Manufacturing; J. B. Armitage, Vice President in charge of Engineering; and R. L. Bischoff was appointed Treasurer and Assistant Secretary.

Get More
SPEED
and Greater
FLEXIBILITY
with
CULLMAN DRIVES
Machine tools, now shaft driven, can be modernized with Cullman Drives for individual control to give increased production of more than 25%.
Cullman Drives can be installed in from two to four hours. Only four bolts are required. Cullman Drives are available for motors from ¼ to 15 H.P. Prompt deliveries can be made on most sizes.
Write for facts on 60 day trial plan.
CULLMAN WHEEL COMPANY
1332 ALTGELD STREET • CHICAGO, ILLINOIS

The McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa., has taken

McKenna Metal Directs Sales of Grayson-Kennametal

over the direct sales, engineering and service of Grayson Kennnametal milling cutters. These cutters, made with Kennametal tips exclusively, will be distributed and serviced by the national and foreign sales organization of the MeKenna Metals Co. This move will enable the metal working industry to obtain these standard carbide-tipped milling cutters for face, end, slot and straddle milling upon the receipt of orders at the McKenna Metals Co. at Latrobe, and other sales engineering offices throughout the country.

(Cont'd on Page 174)

Better work at lower costs — is the universal report from shops using Center Scope, the optical locating tool. Job time estimates are being reduced, because Center Scope makes locating time shorter and gets more work out of each machine tool, from bench drill to lathe or jig borer.

Center Scope can be used without technical knowledge or training, and produces accuracy of plus or minus .0001" or better the first time an operator uses it.

Used on any machine tool, it is a precision instrument, not affected by wear, temperature, or mechanical pressure.

Center Scope has many major functions applied to general machine shop work and to special and individual jobs.

Prices are attractive, too. Variable Center Scope, only $97 f.o.b. Los Angeles; Edge Block, $23 additional. Other models slightly higher. For full information, write for Bulletin No. CS301.

You've done your bit. Now do your best.

Buy a War Bond — TODAY

Rotary Head Milling Machine
Autometric Jig Borers
Center Scope

Kearney & Trecker
Products
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

INDUSTRIAL DIGEST

(Continued from Page 172)

Workers' Ideas Needed To Win War

Speaking before the National Association of Suggestion Systems, Charles R. Riker, Westinghouse suggestion system coordinator, declared that American war industry must get production-increasing ideas from the men and women down in the shop in order to send the armed forces sufficient equipment for final victory. The ordinary workman through the suggestion system can be of very great help in solving the tremendous problem of doubling production with existing means.

The typical American, Mr. Riker declared, is a "chronic grouser" who is always finding fault. This is recognized in the Army and encouraged, he said. It should also be encouraged in our production army. Developing a good suggestion involves merely turning a grouse into a constructive idea. That is, it involves finding fault with an existing condition, method or operation and then developing a practical means of overcoming present defects or limitations. The trouble is that most people stop at the initial fault-finding stage. We must encourage them and show them how to take the second constructive step which leads to good suggestions, Mr. Riker stated.

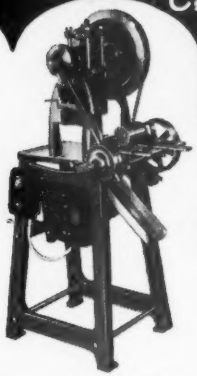
* * * *

C. K. Swafford, works manager and member of the Board of Directors of Gisholt Machine Co., was elected a vice president of that firm at the annual meeting of the Board of Directors. He will also continue in his capacity as works manager.

* * * *

The Army-Navy Production Award was recently presented to the men and women of Chambersburg Engineering Co. The presentation was made on Friday, June 25.

DIEBEL Hi-Speed 550 RPM STAMPING PRESS
Cuts Production Time
FROM 800 hours
TO 35 hours
ON SINGLE WAR-TIME ORDER



Press Pays for Itself on just ONE job!

Stamping production of small aircraft part is boosted from 400 per hour to 12,000 per hour — costs cut from $800 to $30.

[Because of war restrictions, illustration or description of part is prohibited.]

The Diebel Hi-Speed Press is the ideal machine for all small punch work. It saves power, labor, space, money.

WRITE FOR BULLETIN

SEND SAMPLES OR BLUE PRINTS — QUICK DELIVERY

DI MACHINE CORP.
DIVISION OF DIEBEL DIE & MFG. CO.
3653 N. LINCOLN AVE. CHICAGO

Keep this Point in Mind

FEATURES of SUPERIORITY

Simple Design . . . Precision-Built . . . Heavy Duty Ball Bearing for Greater Thrust Load . . . Heavy Duty Roller Bearing for Greater Radial Load . . . Needle Bearing for True Running . . . Large Spindle . . . Small Head . . . Short Overhang . . . Locking Feature for Redressing Point without Disassembling . . . Lubricated—with Oil Seal Lubricant Retainer . . . Cork Thrust Pad Compensator for Expansion of Work.

MOTOR TOOL Ball and Needle Bearing LIVE CENTERS

are as nearly FRICTION-FREE *as scientific engineering can make them*

Chances are you will wear out a dozen "dead" centers before you even have to dress the point of a MOTOR TOOL. And, in a MOTOR TOOL, there still are years of service if run at rated loads and speeds.

a vital point to keep in mind when buying centers

MOTOR TOOL MANUFACTURING CO.

METAL CUTTING TOOLS

7779 CORTLAND AVENUE • DETROIT, MICHIGAN

Make it a Rule to Call Motor Tool

"TIME SAVER"

Improved holder with interchangeable steel type makes part number changes a simple operation. Turn a screw to make the change. . . .Guaranteed for years of service. Used by hand or press, it's a time and money saver.

STOCK SIZES:

TYPE #1

TYPE #2

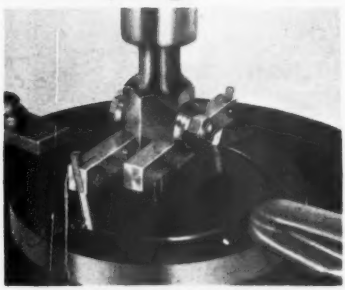
TYPE #3

PROMPT DELIVERIES

SOSSNER

161 GRAND STREET
NEW YORK CITY

New Adjustable FLY CUTTER



Facing steel with Clark Adjustable Surface Facer

Clark Adjustable Hole Cutters cut accurate, clean holes quickly in stainless steel, pipe, plastics, etc. Only seven sizes cover all fractional diameters ⅝" to 3" and up to 1" thickness!

Holes or Discs 4" to 10"
One Inch Thickness Capacity
Unique Blade Arrangement
Simplified, Long Life Design

This remarkable new Clark Cutter does the work of several tools, results in substantial operating economies. PITCHED BLADES of precision-ground High Speed Steel set with 11-degree drag cut true and smooth . . . relieve chatter; make clean, long-curl chips, give longer bit life. REMOVABLE PILOTS, hardened and ground, permit use of lead drills. Only ⅛ inch work clearance is required; allows deeper cuts without undue blade stress. Straight or tapered shanks. PROMPT DELIVERY on suitable priority.

Write for Bulletin No. TDJ-7

CANADIAN DISTRIBUTOR: DOMINION BEARINGS, LTD.
Toronto • Montreal • Winnipeg

Robert H. Clark Company

3424 SUNSET BOULEVARD, LOS ANGELES 26

Manufacturers: Precision Tools, Precision Parts

STEEL STAMPS AND DIES

For embossing and stamping lettering
and designs on all products

Master hobs and cavities
for all insignia and
buttons.

Sossner **STEEL STAMPS** for
every marking purpose
... for use by
hand or machine.
A 33 year reputation
for precision workmanship
on dies and stamps.

ALSO: TAPS • GAGES •
CUTTING TOOLS

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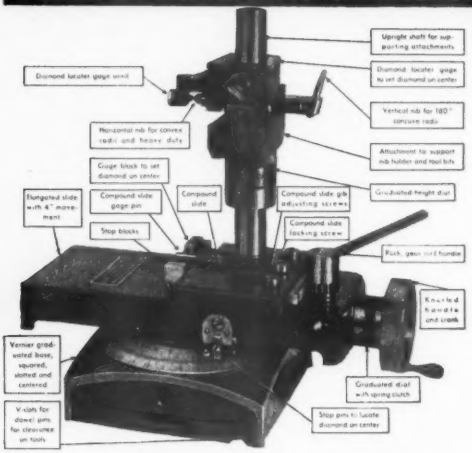
161 Grand Street • New York, N. Y.

THE *New* MEYERS *Microform* WHEEL and TOOL FORMER


Upright shaft for supporting attachments
Diamond locater gage wind
Diamond locater gage to set diamond on center
Vertical nib for 180° concave radii
Horizontal nib for convex radii and heavy duty
Attachment to support nib holder and tool bits
Gauge block to set diamond on center
Hungated slide with 4" movement
Compound slide gage pin
Compound slide
Compound slide gib adjusting screws
Graduated height dial
Stop blocks
Compound slide locking screw
Rack, gear and handle
Knurled handle and crank
Vernier graduated base, squared, slotted and centered
Graduated dial with spring clutch
V-slots for dowel pins for clearance on tools
Stop pins to locate diamond on center

A "2 IN 1" PRECISION TOOL THAT SAVES HOURS IN TOOL & WHEEL FORMING

●

This new tool forms difficult contours on tool bits, milling cutters, die sinking and other forming tools in record time — with keen, sharp outlines, a semi-micro-inch finish, and precise, uniform clearances. It also forms similar outlines on grinding wheels—with smooth, sturdy precision. Engineered for mounting on various machines. Vertical and horizontal diamond nibs are furnished for completing concave radii from 2" to 3/16", convex radii from 2" to zero. Literature on request.

Manufacturers' representatives wanted in East, West and South.

W. F. MEYERS CO., 1016-14th ST., BEDFORD, INDIANA

UNBRAKO

Reg. U. S. Pat. Off.

SOCKET HEAD CAP SCREWS

Made to fit the fingers

The knurled head prevents slipping—permits the fingers, handiest of wrenches, to be used to best advantage. Saves time and lost motion. Knurling also permits locking after countersinking. You get this "Unbrako" knurled feature at no extra cost.

Sizes: No. 4 to 1½" diameter

Write for "Unbrako" catalog today.

Knurling of Socket Screws originated with "Unbrako" years ago.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 600

BRANCHES

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

SHOP AIDS

TO THE LARGE NUMBER OF SHOP NEOPHYTES—untrained in the interpretation of blueprints of machine drawings, D. E. Hobart has addressed the revised edition of his book entitled "Blueprint Reading". Mr. Hobart is a professor of mechanism and engineering drawing at the University of Michigan. The course offered in his book is the outgrowth of his experience in teaching the subject at the General Motors Institute.

In addition to a detailed explanation of orthographic projection, and thorough instruction on the various steps of reading and making the drawings, the author includes a series of work problems for his students to solve. Published by Harper & Bros., New York, N. Y., the book sells for $1. **54-A**

"WITH A VIEW TOWARD HELPING ALL—who own or operate planers to get the best results from them", The Cincinnati Planer Co. prepared their second edition of "Treatise on Planers". Since the first publication of this popular book over thirty years ago, the fundamental principles of accurate planing have not changed, but the design and construction of the planer itself have, of course, been greatly improved in many ways.

The Cincinnati Planer Co. believes that by studying the newer designs of planers, by becoming familiar with their operation, and by noting the ways in which they work, shown in the different examples in the book, planer men will broaden their experience and become more proficient. The book is well written and illustrated. Price $1.00 from The Cincinnati Planer Co., Dept. TJ, Cincinnati, O. **55-A**

"MACHINE DESIGN"—by Hyland and Kommers represents a treatment of the subject that is arranged to give the maximum practical help, with definitions, fundamentals, working data and design methods presented in the most concise, direct form. It covers both the general considerations and specific facts of materials and manufacturing methods that affect the problem of machine design, and explains in detail the methods of designing all the basic machine parts.

Well illustrated, the book will serve as a convenient, dependable reference. Included are chapters on the specific methods of designing cams, bearings, riveted joints, screw fastenings, shafting, couplings, welded joints, keys, toothed gears, belt drives, machine frames, etc. Over one hundred useful tables of information are given. Available from McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. Price $4.50. **56-A**

THE METHODS OF TRANSMITTING AND CONTROLLING MOVEMENTS—are explained in "A Manual of Mechanical Movements" by Will M. Clark. He states that the simplest as well as the most complicated machines perform their work by integrating fundamental mechanical movements; the principles of motion are in themselves simple, no matter how complex a given mechanism. It is from this point of view that the book is written. It describes these rudimentary principles and traces their development in application.

The field is comprehensively covered; the descriptions are clear and the illustrations simple, demonstrating the principles in operation. The book explains, by diagram and text, the methods of changing rotary into rectilinear motion, rectilinear into oscillating motion, slow motion into fast motion and hundreds of other principles that go to make up modern machinery. The book

(Continued on Page 181)

"Good Machinery Is A Good Investment"

Do You Want a MACHINE TOOL

or an Emery Wheel Stand?

For tool sharpening and small parts production work you must have a grinder with true, smooth spindle rotation to get the most out of high-priced grinding wheels. With Marschke Pedestal Type Grinders you get this basic, requirement PLUS *maximum convenience and safety of operation* . . . derived by the patented Marschke Universal Guard with spark shield over wheel opening being brought *automatically* into proper relation with wheel when work rest is adjusted to follow wheel wear. Ask Marschke representative in your area to give you details or WRITE DIRECT TO—

"THE MARSCHKE LINE"

Manufactured and Sold by the

Vonnegut Moulder Corporation
1853 Madison Ave. Indianapolis, Ind.

Over 70 specifications of Marschke Swing Frame Floor Stand and Pedestal Grinders and Buffers—from 1 to 25 HP. Each built to machine tool standards . . . made to give long, dependable service under severe operating conditions.

No. 1F FOOT-OPERATED ACROMARKER

SINGLE DIES . . .

Each single die or diehead is easily removed for interchanging sizes. An assortment of dies is available to meet all requirements.

Stamps Nameplates up to 9" x 5" x 5/8"
Foot Operation Frees Both Hands for Feeding and Indexing.

Similar in operation and efficiency to the extensively used NO. 1 ACROMARKER, the No. 1F type is mounted on a cast iron pedestal for foot operation. Only slight pressure is needed for perfect, uniform stamping and marking parts of stainless steel, cold rolled steel, brass, bronze, zinc, tin, plastics, fibre and other materials. Die wheel carries and stamps complete alphabet and all numerals.

Write for illustrated literature today.

ACROMARK

THE ACROMARK COMPANY
515 MORRELL STREET, ELIZABETH, NEW JERSEY

(Continued from Page 179)

should be of great value to the mechanic, artisan, inventor and student. It may be obtained from the Garden City Publishing Co., 14 W. 49th St., New York, N. Y. Price $1.98. **57-A**

"HERE'S HOW TO KNOW HOW—ON GEAR CUTTING TOOL CONSERVATION"—is the title of a new folder that reprints several in the popular series of Michigan Tool advertisements featuring methods of conserving and increasing output from gear cutting tools. Included are "15 Ways to Get More Out of Shaper Cutters", "15 Ways to Get More Out of Hobs", and "Do's and Don'ts in Hobbing Worm Gears". The bulletin (No. 531-TJ) is available without cost from the Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **47-A**

THIS MONTH'S GENESEE TOOL CONSERVATION POSTER—is now available upon request for posting on factory bulletin boards. Since a considerable portion of the increase in cutting tool breakage is due to failure of inexperienced operators to watch their machines and tools while cutting, the new 2⅛' x 3½' poster is designed to impress on workers the effect of this form of carelessness.

The poster shows a closeup of two soldiers "on guard" against enemies in the field. Below this is an illustration of a lathe on which the chuck has loosened and tool and work are being wrecked while the operator has his back turned. Below the wording "On Guard . . . are You?" is a repetition of the key to the poster series, "carlessness breaks valuable tools—there is only so much tool steel available." For your copy, address the Genesee Tool Co., Dept. TD, Fenton, Mich. **49-A**

A CONVENIENT WALL CHART COVERING—the standard carbide tools manufactured by New England Carbide Tool Co., 60 Brookline St., Cambridge, Mass., is available on request. The chart gives the width, height and length of the tools, prices for left hand and right hand models, and degrees of front clearance, side clearance, side rake and back rake. Diagrams of standard tip forms are also included. Chart size: 8½" x 11". **58-A**

THE FIRST INSTALLMENT ON THE USE—of Diamond Tools in Industry appears in the latest issue of the J. K. Smit & Sons, Inc., house organ, "Diamonds in Industry". This small magazine contains important technical information on the part the diamond is playing in war work. Interested parties may be put on the mailing list if they will write to Dept. D, J. K. Smit & Sons, Inc., 157 Chambers St., New York, N. Y. **48-A**

2 Small Parts Clamped in Exact Positions with

DE-STA-CO Toggle Clamps

A difficult arc butt weld job is performed swiftly and accurately through use of two De-Sta-Co Toggle Clamps—the smaller one bolted to the work bar of the larger clamp. Note that because of this unique set-up, there can be no variation in the point of welding. Also that parts can be inserted and withdrawn in minimum time. . . . A simple, inexpensive, time-saving fixture.

For clamping parts in production, use De-Sta-Co Toggle Clamps. . . . Available in all types and sizes. . . . Bulletin No. 43, illustrating many practical uses, sent free on request.

DETROIT STAMPING CO.

Established Over 25 Years

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Valuable Booklet Available

Forgings For All Industries
Rough Turned or Finished Complete

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Composite Die Sections Extrusion Tools
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Rings, Discs, Blocks, Shafts, Hubs,
Bars, and Special Shapes.
Tool Steel of all Makes

S.A.E. and NE Specifications
STAINLESS & COPPER FORGINGS

May We Serve You?

AJAX STEEL AND FORGE Co.
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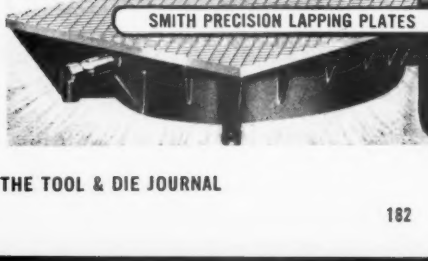
On specifications requiring a total flatness tolerance of one ten-thousandths of an inch, medium size Smith Master Surface Plates have successfully met the test to the entire satisfaction of hard-to-please users.

Precisely--- RIGHT

Present day inspection and assembly demands surface plates of utmost precision accuracy. Plants engaged in aircraft and ordnance production throughout the country have come to depend on Smith Plates. Their complete satisfaction is evidenced by frequent reorders. If your requirements call for precision accuracy, wire, phone or write.

SMITH TOOL & ENGINEERING CO
Precision Measuring Equipment
858 North Sandusky St., Bucyrus, Ohio

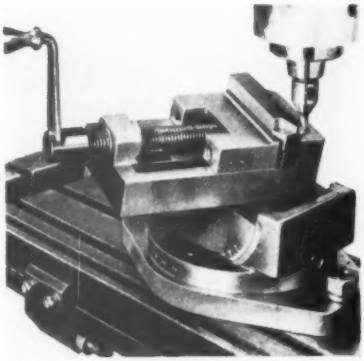
Available Sizes	8" x 12"	18" x 18"	20" x 30"	30" x 60"	
	9" x 14"	18" x 24"	24" x 36"	36" x 68"	
	12" x 18"	24" x 24"	30" x 36"	48" x 96"	



The same close tolerance accuracy for developing a true plane when lapping metal to metal joints, characterizes Smith Precision Lapping Plates in the same manner as will be found in Smith Master Surface

Vise Reduces Setup and Tool-up Time

THE Wesson universal vise may be mounted on any machine tool for any angle machining operations. It permits production of even the most complicated compound angles quickly, easily and with precision.



Setup and tool-up time is reduced to a minimum—jobs that would ordinarily take hours to set up can be done in minutes. Angle milling, drilling, grinding, boring, reaming, slotting, and other machining operations involving angles can be handled.

The vice is easily and quickly mounted by T-bolts to any machine and may be moved from one machine to another without disturbing the angle or removing the work. This permits a series of angle operations at the fixed angle required.

The vise swings through 180° in the top plane, 90° in the vertical plane and 360° in the bottom plane. Vernier graduations, for use where extreme precision is required, are available at additional cost. The compact Wesson vise is made in two sizes: No. 1 has a jaw opening up to 4″ and an overall height of 6⅛″; No. 2 with a jaw-opening up to 1⅜″, has an overall height of 4⅜″. Both are of highest quality construction and may be equipped with angle plate for parts that are too large or too irregular to be held securely in a vise.

Full information will be furnished by Wesson Co. (Ferndale Station), Detroit, Mich.

DO THIS FASTER
AND AT LOWER COST
WITH THE NEW
Hammond
4-B CHIPBREAKER
Do you tie up millers or surface grinders for carbide tool grinding jobs? Don't do it! Investigate the new Hammond 4-B — built specifically to grind chip breaker grooves easier, faster, better. Write today for BULLETIN 201 which shows how you can get complete and proper carbide tool maintenance.
V-BELT DRIVE PERMITS ANY ELECTRICAL SPECIFICATIONS
Hammond
Machinery Builders INC.
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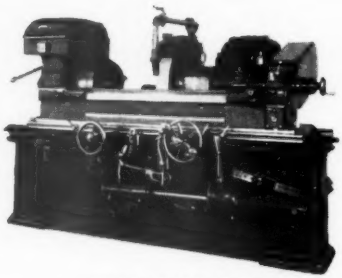
Eastern Branch—71 West 23rd Street, New York, N. Y.

HILL-CLARKE

Modernized

CYLINDRICAL GRINDERS

for **SUPER-GRINDING**
and **MICRO-FINISH**



Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."

SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

HILL-CLARKE MACHINERY CO.
646 WASHINGTON BOULEVARD CHICAGO, ILL.

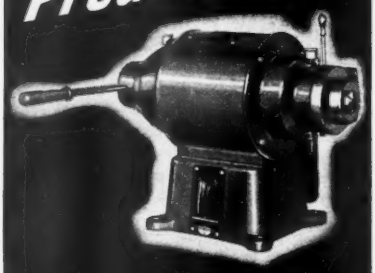
ARE YOU TOOLED *for* FASTER Production?

USE **SCHAUER**
SPEED LATHES

BURRING - LAPPING - POLISHING - and FINISHING operations of gears, pinions, pulleys and similar parts.

Used by Pratt & Whitney Aircraft, New Departure Mfg. Co., Winchester Repeating Arms, GMC, Lukas-Harold Corp., Wright Aeronautical Corp., Army and Navy Stations and many others.

Write for Catalog No. 420



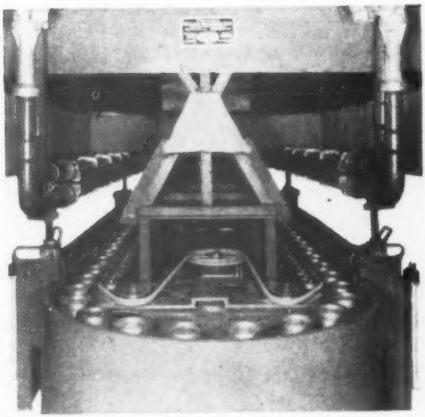
ARMY NAVY

"the originators of today's Speed Lathes"

SCHAUER MACHINE CO

2076 READING ROAD CINCINNATI, OHIO

Annealing Machine For Larger Steel Cartridge Cases



SOME months ago, Morrison Engineering Co. developed a flame type mouth and body annealing machine for 20 mm steel cartridge cases. Operation is simple. A steel conveyor chain is placed on its side and driven by a variable speed drive through a totally enclosed worm gear reducer.

This chain carries double row ball bearing mounted spindles every pitch. These spindles, in the form of a V-belt pulley, are rotated by a V-belt backed up by adjustable ball bearing wheels. In certain sizes and models, the spindles are sprocket equipped and driven by an adjustable steel roller chain. The spindle rotating mechanism is driven by a separate motor, which is provided with its own variable speed unit and a totally enclosed worm gear speed reducer.

The burner equipment is of the blast line type with zero governors and proportional mixers provided for each burner. By operating at comparatively high mixture pressures and by rotating the work from 60 to 100 rpm in front of the burners, extremely fast heating is attained. There is no perceptible cooling due to rotation even on the large size cases.

The efficient and speedy manufacture of 37, 40, 57, 75, 90, 105 mm and 3" steel cases created a need for a machine of the contin-

(Cont'd on Page 187)

SPEED WAR WORK

by magnetically removing metallic particles, suspended in oil. Prolong tool life, protect machines and improve finish. Indispensable for gun boring, reaming and rifling machines, and the manufacture of steel cartridge cases. Frantz permanent magnet Ferro Filters are available in sizes to meet your requirements. They soon pay for themselves and show a profit. Catalog on request. S. G. Frantz Co., Inc., 161 Grand Street, New York, N.Y.

FRANTZ FERRO FILTERS

DARWIN STEELS

Stand for Quality

We were the Originators of HIGH CARBON-HIGH CHROME Steels with NON-DEFORMING Qualities, opening the way to

Quantity Production

for all kinds of Dies and Press Tools with High Carbon-High Chrome Steel

Oil-Hardening
"NEOR"

and

Air-Hardening
"COBALTCROM-PRK"
—the latter also in CAST FORM

which have become the STANDARD on which all subsequent similar kinds of Steel were based.

We supply also

High Speed Steels

in Bars, Forgings, Tool-Bits as well as all types of

High Grade Tool Steels

Write for descriptive Circulars

TOOL STEEL CASTINGS

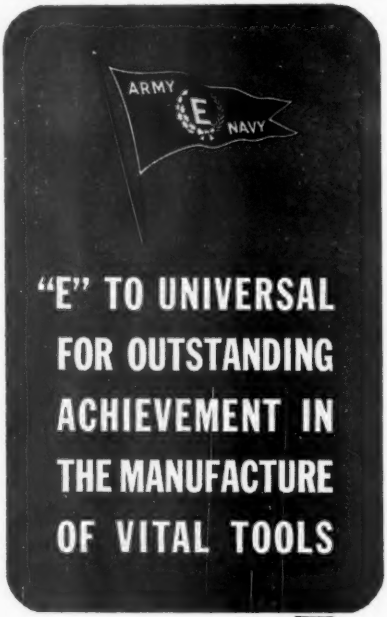
and

FORGINGS

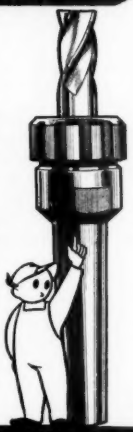
DARWIN & MILNER, Inc.

1260-64 W. 4th St. Cleveland, O.

A SERIES of interesting bulletins tells the story of the Ziegler Roller Drive Floating Tool Holders. Full descriptions, specification charts and blueprint drawings are included. Request copies from the W. M. Ziegler Tool Co., 1927 Twelfth St., Detroit, Mich.

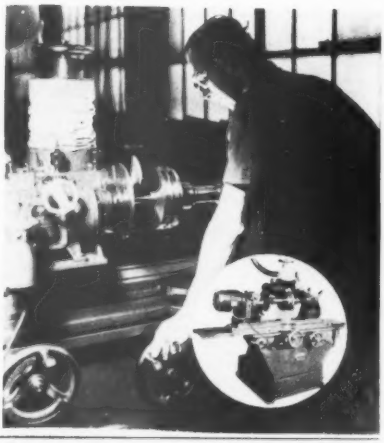


We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort. You can improve production with Universal Collet Chucks which grip as strong as solid steel in both a radial and axial direction without marring shank. Write for facts.



UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

Grinding of Rolls Simplified by Yoder



THE designing and manufacturing of roll forming machines and their rolls have been carried on for over 30 years by The Yoder Co. Their concentration on a particular problem in the grinding of rolls resulted in a simplified and efficient way of doing the job.

With a new design and the elimination of adjustments, usually included on a grinder and not necessary to this particular group of operations, savings in time and money and ease of handling resulted.

High points of the Yoder roll forming machine are: 16″ diameter capacity; 20″ length between centers; manually synchronized table and cross feeds; two-speed table feed; nine-speed work head drive, precision built high speed spindle; centralized controls; operation without belt or gear change and complete dust protection.

The Yoder Co., Dept. TJ. Cleveland, O., will send full data.

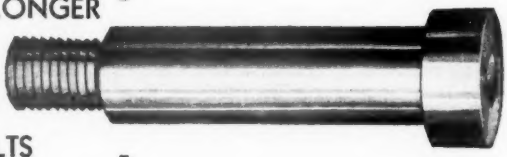
(Cont'd from P. 185)

uous type that would produce a uniform and satisfactory anneal before tapering. In order to cover this range, the following three models of basically the same machine were designed: the 3740 size for 37 mm and 40 mm cases; the 5710 size for 57, 75 and 105 mm cases; and model 390 for the 90 mm and 3″ anti-aircraft cases. Production varies from 400 to 2000 cases per hour.

Morrison Engineering Co., Dept. TD, Cleveland, O., will send further data.

Here's What You Need For . . .
MANY TEDIOUS JOBS
Time—our most valuable asset today—can be saved by the use of a Duro Hand Grinder. Cutting, grinding, polishing, etc. on small parts requiring hand work, is easily and rapidly executed.
Duro Hand Grinders are powerful and durable. The G. E. Universal Motor develops 42 watts output running at 24,000 R.P.M. Kept cool in operation by propeller type fan. Spindle operates on sealed N. D. ball bearings which take up all radial and thrust load. Fitted with collet chuck up to ⅛″ capacity. Streamlined to fit operator's hand. Ideal for tool post grinding.
Ask for details and list of accessories
Duro Metal Products Company
2653 N. Kildare Ave. CHICAGO, ILL
DURO HAND GRINDER
DURO ADDS DURABILITY★
FOR DIE WORK
FOR TOOL POST GRINDING
FOR POLISHING
FOR ROUTING
FOR DRILLING
FOR

DIES GIVE BETTER, LONGER SERVICE WITH *SAFETY SOCKET* HEAD STRIPPER BOLTS



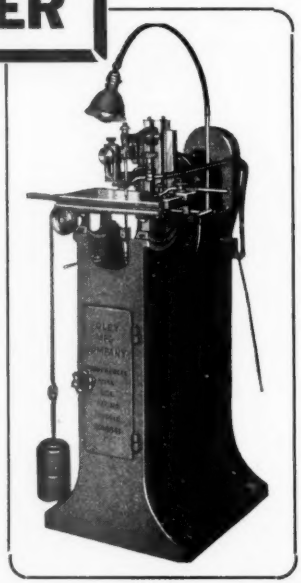
- Methanol Method of Heat-Treating Insures a Clean, Uniform Bolt
- Special Attention Given to Close Tolerances. All Body Diameters Ground Accurately
- Under-cut to Allow for Tightening Flush to the Shoulder
- Concentricity Between Head and Body Guaranteed
- Fabricated from Special Alloy Steel
- Threads Die Cut, Held to High Limit, Class 3 Fit

CINCINNATI: WM. BUCHANAN SUPPLY CO., 339 E. 3rd ST.
YOUNGSTOWN: C. H. WILTSIE, 4177 OAK KNOLL DR.
ELLWOOD CITY, PA.: JOHN S. FISHER, 9 FIFTH AVE.
PITTSBURGH: L. A. REISMAN, 2035 FIFTH AVE.

MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

FOLEY DIE MAKER

Takes ANY Standard or Special Saw or File



Handles most intricate dies with small holes and sharp corners, as only smallest lead hole through which saw or file can pass is necessary. Compound angle filing is fast, accurate and easy with the **Foley Die-Making Machine.** Adjustable table tilts 20° front, 10° back. Ram tilts 20° right or left. Has 6⅜" throat—saws to center of 12¾" piece.

USES ANY STANDARD OR SPECIAL FILES—From the smallest needle file to the coarsest bastard file can be used in this machine without any special holding fixtures.

TAKES ANY SAW—Any type of saw from the finest saw to the high power high speed saw can be used without delay of changing holding fixtures. No holes in blade necessary.

PAYS FOR ITSELF—The **Foley Die-Making Machine usually pays for itself in 400 working hours.** Write today for literature and full details.

FOLEY MFG. CO. 4 Second Street N. E., Minneapolis 13, Minn.

Manufacturers of FOLEY Automatic Saw Filers, Grinders, etc.

Swiss-Type Automatic For Small, Intricate Parts

IN announcing the new 16-A precision automatic screw machine, George Gorton Machine Co. is making a notable addition to their extensive line of precision machine tools. Among the specific parts it is particularly adapted to turning are pinions, shafts, screws and small slender parts used in clocks, meters, radio equipment, precision instruments, guns and aircraft engines. In addition to step and contour turning and chamfering, the machine, with attachments, automatically performs centering, drilling, threading and slotting operations.

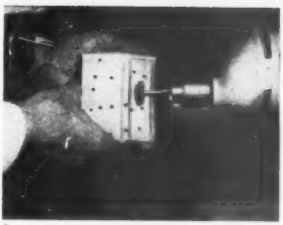
Of special interest is its exceptional simplicity—both in tooling and operation. Only the simplest single-point tool bits are required. The easy accessibility of all tools, cams and controls assures quick setups and economical operation.

The Gorton 16-A differs from the conventional automatic screw machine in its basic principle of operation. Briefly, the operating method is as follows: The stock is fed to the 5-station multiple tool head by means of a cam, through a bushing and past the cutting tools which are stationary in the horizontal plane. Thus, the side thrust of the tools is at the point of work support. This principle explains why parts of extreme diametrical accuracy and high finish can be consistently produced.

All functions are controlled directly from the centralized finger-

(Cont'd on Page 191)

WELDON ROBERTS
Brightboy
REG. U.S. PAT. OFF.



De-burring—finishing holes and edges in Alclad part.

DE-BURRING FASTER MEANS BOMBING SOONER

In plane construction and countless other war industries Brightboy saves time and operations in de-burring, cleaning, finishing, polishing.

Brightboy's resilient rubber binder *cushions* the abrasive — degree of finish and polish is achieved by regulation of machine speed — operations between a grind and a buff are eliminated. Brightboy works metals with minimum dimensional loss. Requires no time-taking preparation. Does not load, gum or fill.

Write us if your dealer cannot supply you with "Methods and Applications" data, catalogs and prices. Our field representatives are at your service.

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark, N. J.

WHEELS
BLOCKS
RODS
TABLETS
— for manual and machine operations

OPTICAL FLATS by Acme

for
SURFACE INSPECTION
for
ACCURATE COMPARISON

★ Acme Optical Flats are finished to a degree comparable to absolute flatness. And, when used to check the *flatness* of a surface, deviations can be quickly detected and accurately measured. Too, they serve as an accurate comparator in connection with your gage blocks as illustrated at right.

Used with the Acme Monochromatic Lamp that provides light of a single wavelength, interference bands appear clear and sharp through the flats.

Above illustration shows an Acme Optical Flat over work and gage for determination of the size of the work.

Complete Details and Prices are yours for the Asking!

ACME

ACME INDUSTRIAL COMPANY

Makers of Standardized Jig and Fixture Bushings

206 N. Laflin St. Chicago, Ill. MONroe 4122

MAJESTIC INTERNAL GRINDING MACHINE

The Majestic Internal Grinder meets the exacting requirements for internal grinding operations in the tool room and die shop. It offers reliable, balanced operation, maximum output and valuable help for all-out production.

Sturdy and durable, the Majestic Internal Grinder is equipped with Parker spindle and motor. Parker ball bearings and standard rotor and stator assure perfect balance for smooth spindle movement.

An adjustable work head has a graduated base which swivels 90 degrees on each side of the center for taper grinding.

Send for valuable circular.

MAJESTIC TOOL AND MANUFACTURING CO.

2946 Woodbridge Street, East Detroit, Michigan

Acromarker Offered In Foot Lever Model

TO speed up war parts marking and the marking of name and number plates, the Acromarker is now offered in a bench type foot operated machine.

This machine, formerly operated by screw pressure from a hand lever, now frees both hands for feeding and indexing by the use of a foot lever. A multiple lever arrangement provides sufficient foot power to deliver pressure equal to the powerful screw pressure of the hand machine. This was accomplished without losing the values of the automatic clutch feed, which advances the part one character space after each impression.

The Acromarker not only uniformly stamps each number or letter into blank spaces of name plates, but also automatically spaces each character, and fills in voltages, serial numbers and other data.

Complete name plates may be made with this machine from scrap material, of steel, brass, plastic or fibre. It carries all the letters of the alphabet and a full set of figures in the die head so that any lettering or numbering can be quickly done.

The Acromark Co., 5-15 Morrell St., Elizabeth, N. J., will send new folder.

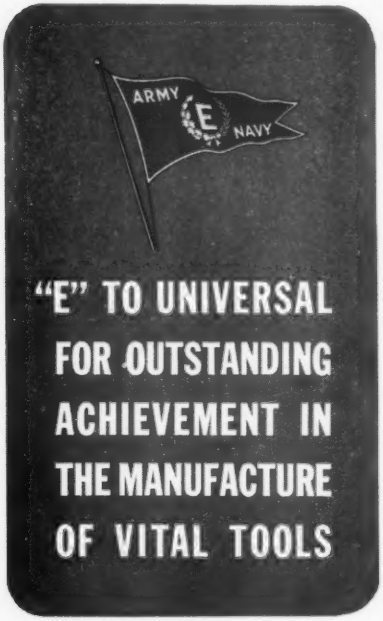
(Cont'd from P. 189)

tip control panel conveniently located on the front of the machine. Infinite variation in spindle speeds — from 1,100 to 10,000 rpm—is provided by a Reeves variable speed drive.

Address George Gorton Machine Co., 1319 Racine St., Racine, Wis., for further information.

Send us your
SPRING PROBLEMS
● If you need special design, special quality or special delivery, the chances are we can help you. Redesign may modify costs, too. This specialized organization, recognized headquarters for all that is latest and best in spring making, is at your service.
WM. D. GIBSON CO.
1800 Clybourn Ave.
Chicago, Illinois
(Div. Assoc. Spring Corp.)
65 Years of Knowing How RESULTS IN BETTER SPRINGS
GIBSON-SPRINGS
INQUIRIES INVITED . . . LARGE ORDERS . . . SMALL

A NEW folder issued by DeVlieg Machine Co., 452 Fair Ave., Ferndale, Mich., describes the No. 3-A—3" Bar DeVlieg Jigmil. Complete with illustrations, detailed information and a range dimension chart. Copies available upon request.



We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort.
You can improve your jig operations with Universal Drill Bushings. They are straight and round and have super-finished bores for accuracy and long life. Write for complete catalog.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

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HY-TEN

S.A.E. • A.I.S.I. • N.E.
ALLOY STEELS

Scientifically selected and designed to conserve critical alloys and meet the carburizing or heat treating requirements of the Machine Tool and Aircraft industries. Call our nearest office and warehouse for up-to-the-minute information.

WHEELOCK, LOVEJOY & CO., INC.

CAMBRIDGE • CLEVELAND
CHICAGO • NEWARK
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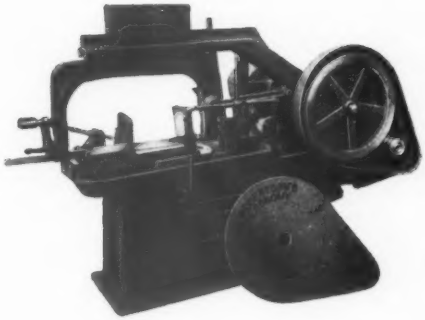
CINCINNATI

Economy Power Saw For Production Metal Cutting



THE Robertson Model 4-X Power Saw shown here is built for heavy, continuous production metal cutting. Both the Journal and Slide Bearings are extra large and spaced far apart to give greater strength and rigidity. The Journal bearings are easily accessible and can be removed for replacement. All are phosphor bronze bushed.

The Frame Slide Bearing is of dovetail construction, of ample size and fitted with steel gibs for adjustment. The saw has a standard 6" stroke. It has a 9" x 9" capacity, with 12" to 18" blades. The feed is by gravity with the aid of adjustable weights. The weights are mounted on a tee rail, which is cast integral with the frame slide arm. This construction applies the pressure directly over the center of the blade.

The Vises are quick acting, and swivel to 45° for angle cutting. They can be entirely removed from the bed of the machine for clamping irregular shape work.

For complete details, address the W. Robertson Machine & Foundry Co., Inc., 59 Rano St., Buffalo 7, N. Y.

HIGH SPEED
Precision
DIE WORK, JIG AND MODEL MAKING, METAL PATTERNS, DRILLING, MILLING, REAMING, JIG BORING

LINLEY

. . . The machine that "can take it" . . . and do it. **From every point of view . . . compactness, rigidity, accuracy, speed and versatility, the Linley Milling and Jig Boring machine can be the busiest unit in a busy toolroom. Eight spindle speeds from which to choose, direct micrometer setting to eliminate pencil figuring errors, counterbalanced quill to remove backlash . . . and a large capacity for such a small (18½" x 20" floor space) machine.**

You'll want full details . . . write today.

LINLEY **BROTHERS COMPANY**
662 State St. Extension
BRIDGEPORT, CONN.

Break Production Bottlenecks

with modern

FLEX-ABRASIVE

WHEELS and POINTS

A new line of abrasive wheels and points with patented construction features that place a fresh abrasive surface constantly in contact with the work and allow full use of the spiral roll, down to its final layers. These sharp, cool and smooth-running abrasive wheels and points can easily deburr exterior edges and finish irregular surfaces—such as holes, openings, and corners. For use on hard alloy steels, wood, rubber, resin and plastics. Mandrels are of tapered thread construction which firmly locks the abrasive wheel or point to the shaft by its rotary motion. Operator can instantly remove or replace wheel or point from mandrel without use of tools, nuts, split shafts or grommets. Our engineers are at your service.

Send for Samples and Catalog

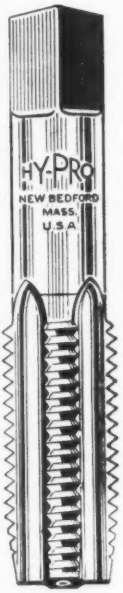
THE FLEX-ABRASIVE CO.

REG. U.S. PAT. OFF.

Division T, 100 North LaSalle St., Chicago, Illinois

HY-PRO

TAPS



High Speed Steel

HAND and MACHINE SCREW TAPS

Cut Thread, Commercial and Precision Ground Thread Taps

Special Ground Thread Taps

Send for Catalog on Company Letterhead

HY-PRO Taps have Clean, Sharp, Accurate Threads for High Production

BUY MORE BONDS

HY-PRO TOOL CO., Inc.

489 Mt. Pleasant St., New Bedford, Mass. U. S. A.

New Grinding Wheels Made Without Rubber or Steel

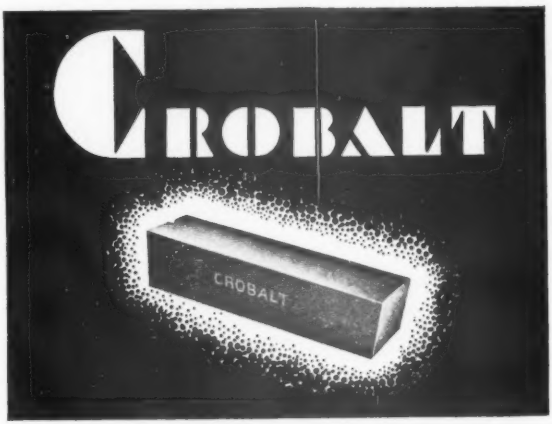
FOR years Industry had accepted as necessary the steel back plate vulcanized to all cylinder type wheels, even though it was known that the extra weight on the wheel increased vibration and added to the wear on machine bearings. Recently engineers at the Tiffin, Ohio, plant of the Sterling Grinding Wheel Div. went to work on the problem of making cylindrical grinding wheels without using steel or rubber. After many tests, they hit upon a tempered pressed wood product made from sawdust and wood shavplate.

The pressed board was cut and bored to the size wheel desired. A cementing mixture composed of phenol and other ingredients was developed and made capable of holding the plate to the wheel without using rubber.

"Sterback" wheels are fast and efficient units for the grinding of Tungsten Carbide metals, bits, drills, dull points and all steels.

For the present, Sterback wheels are manufactured in 5", 6", 7" diameters, 1" and 1½" thicknesses with 3½", 4" and 5" arbors. They come in two series: No. 10 series in fine, medium and coarse for roughing, semi-finishing and finishing of Tungsten Carbide; No. 20 series for the sharpening of all high speed tools, drills, bits, etc. A third series, No. 30, is being developed for use on all types of hard steels and will be available shortly.

Sterling Grinding Wheel Div., Dept. TD, Tiffin, O., will send further details.



A NON-FERROUS HIGH SPEED CUTTING ALLOY WITH THESE ADVANTAGES:

- **Hardness at high temperature**
- **Superior abrasion resistance**
- **Superior resistance to impact**
- **Freedom from chipping**
- **Available in solid tools or inserts**
- **Requires no change in equipment**

Write for catalog and prices.

CROBALT INC.
ANN ARBOR, MICH.

Convenient! ... Saves Valuable Time!

TOOL MAKER'S BENCH LAP SET

SEVEN of the sizes most commonly used in tool and die work are selected in making up this Bench Lap Set.

Complete Set consists of one lap each of the following sizes: 1/8"-3/16"-1/4"-5/16"-3/8"-7/16"-1/2"; convenient die cast Base; one 6-ounce can of Copper Head Lapping Compound.

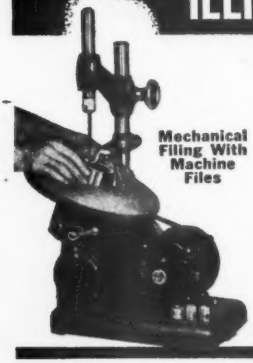
Shipped From Stock

$7.50 COMPLETE

BOYAR-SCHULTZ CORPORATION

2112-H Walnut Street CHICAGO, ILL.

ILLINOIS DIE FILING MACHINE



Reduce costs and improve quality with this TRIPLE-PURPOSE Machine

A versatile bench type machine for all three major production steps in the die-making process—sawing, filing and stoning. Quality built throughout to stand up longer and produce more accurate work. Forced-feed lubrication plus hardened and ground shafts running in bronze bushings combine to minimize wear and prolong life. Maintained accuracy is secured through holding chuck and clamping device which provide positive file alignment, and balanced moving parts which operate without vibration. *Write for descriptive literature.*

ILLINOIS TOOL WORKS

Manufacturers of Metal Cutting Tools and Shakeproof Products

2501 N. Keeler Avenue Chicago, Illinois

Tough Grinding Simplified By New Segmented Chuck Design

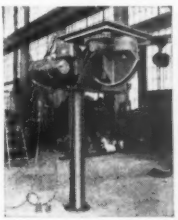
THE remarkable results achieved in surface grinding with the Cortland segmental chuck assembly are due, according to the manufacturer, primarily to two outstanding improvements in basic design—the shape of the segment and standardized simplified chuck.

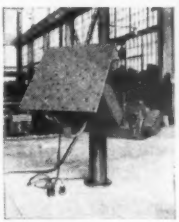
Each Cortland segment is a true segment; that is, the inner edge of the grinding face is a straight line, while the outer edge is an arc. The grinding area is narrow at each end and wide in the center.

As the narrow end of the segment starts to pass over the surface to be ground, contact area is small and the surface exposed to coolant is relatively large. The straight inner edge of the segment travels diagonally over the surface, producing a powerful shearing or cutting action. There is also continually increasing contact between the abrasive and the work being ground, resulting in rapid stock removal with minimum heat generation.

The Cortland segmental chuck incorporates a number of special features developed to improve safety and promote speed and interchangeability. Among these are: balance, light weight, interchangeable segments and quick resetting operations. The chuck comes in six standard sizes.

For descriptive literature address Cortland Grinding Wheels Corp., Dept. J, Chester, Mass.





C-F POSITIONERS ***are universal tools . . . for handling and holding work***

Capable of tilting, turning and holding giant weldments and assemblies so that every weld can be made down hand, C-F Positioners also save time, labor and lower the cost of positioning and holding work for chipping, snagging, grinding, flame hardening and machining operations like angular drilling, etc. Today C-F Positioners are found not only in the welding shops but in machine shops, die shops and production lines as well. 6 sizes, capacities from 1200 lbs. (hand operated) to 30,000 lbs. Each a universal tool, pedestal mounted, adjustable for height, with table that turns completely around and tilts at any angle to 135° from horizontal.

WRITE FOR BULLETIN WP 22.

"Adjustable for Height" *C-78*

CULLEN-FRIESTEDT CO.,
1376 S. KILBOURN AVE. CHICAGO, ILLINOIS

Grobet

ROTARY FILES

HAND CUT — MILLED CUT
GROUND FROM THE SOLID

There is a Grobet Rotary File, Cutter, Diesinker's Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc.

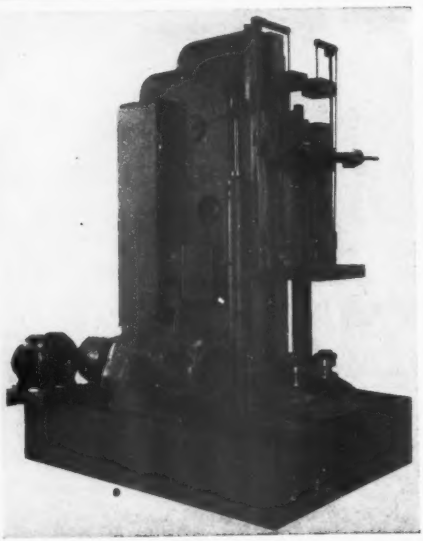
Send for Catalog Y. R. illustrating the complete line in full size, speed charts, etc.

GROBET FILE CO. of AMERICA

421 Canal Street — 1812 — 1943 — **New York, N. Y.**

F. L. GROBET

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES



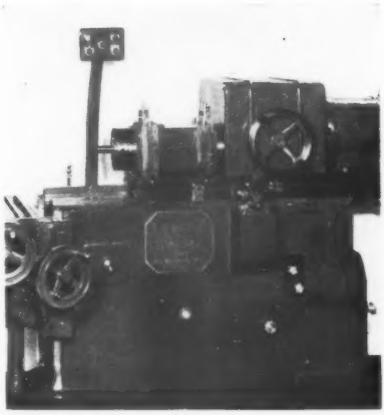
SKILLED IN SERVICE
BAKER
30-HO 2-SPINDLE
INVERTED DRILLER

ARMY (E) NAVY

MORE than ever before, due to urgent wartime needs, SERVICE —smooth, free from all bottlenecks— is in demand. Baker two-spindle type drillers are playing a vital part in helping to achieve maximum production and efficiency. The machine drills deep holes and allows for ready removal of chips with maximum drill life and low cost production. It is well adapted to handling deep hole drilling operations in airplane landing gear parts, of flanged propeller shafts and in the front end of crankshafts.

BAKER BROTHERS, INC. TOLEDO, OHIO U. S. A.

Flexibility of Design and Application Featured in Simplex



A NEW flexibility of design and application to meet the requirements for accuracy, increased production, lowered tool cost and highly finished surfaces were combined in a series of machines known as the Simplex unit type precision boring machine.

The first new feature of design was the use of welded steel beds equipped with hardened, ground and lapped steel ways. The Vee and flat type ways are used for all precision boring and facing operations.

Tables, heavy sliding members of fine semi-steel, provide ample space for mounting spindles, spindle drive and driving motors. Also carried on the tables are the positive stops for facing to accurate depth and trip dogs for carrying it through a predetermined cycle.

The hydraulic system combines a variable delivery pump for feed and a constant delivery pump for rapid traverse. These pumps are so arranged that special ranges of feed and rapid traverse can be easily furnished without otherwise changing the machine.

Since the spindle is the unit that finally determines the accuracy, degree of finish and rate of production of the machine, the spindle and spindle heads furnished with the Simplex represent a careful blending of the best features of plain and anti-friction bearings with a new method of tool support and adjustment. At its

(Cont'd on Page 205)

You Can't Break It!

SUPER-STERLING

HACKSAW BLADES

are unconditionally guaranteed against breakage in regular use in a hand frame. Available in high speed or molybdenum steel . . . broach or standard teeth . . . hand blades and power blades. Call or write us also for "Sterling" Metal-cutting Bandsaws.

We can fill your requirements for Die Springs, Dowel Pins, Socket Screws, Hardsteel Drills and all other Die Makers' supplies.

DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

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IMMEDIATE DELIVERY

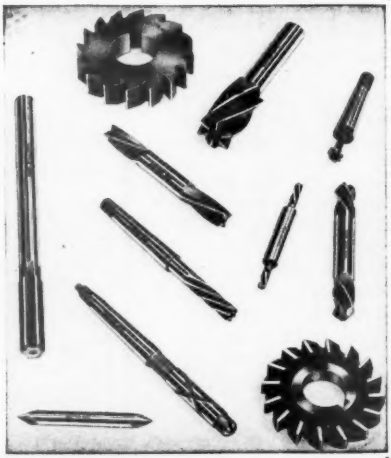
Federal Taperlock
Plastic
GAGE HANDLES

- Made of durable plastic material, they are lighter than any metal used for Gage Handles. This light weight makes gages more sensitive to touch and reduces fatigue caused by long continuous use, particularly in the case of women inspectors.
- Insulates from bodily heat, helping maintain accuracy of gages.
- Made to fit gages of standard sizes. Easily marked for identification with the same lettering stamps used for metal handles.
- New low prices represent a real saving. Available in 6 standard sizes, in any quantity and without delay.
- IN COLORS!! A new feature. Color permits quick identification of type or size without measuring. Furnished in RED—YELLOW—GREEN—BLACK.
- Ideal for the new Glass Gages. These gages require light weight handles for best results. This feature in Federal Handles reduces the danger of breakage and adds to the sensitivity.

FEDERAL TOOL CORP.
400 North Leavitt St., CHICAGO

IMMEDIATE DELIVERY FROM STOCK
On Standard Sizes

GALTER
HIGH GRADE TOOLS



DEPENDABLE PERFORMANCE
Guaranteed

Plain Milling Cutters	Taper Shank Cutters
Side and Face Milling Cutters	Spiral End Mills
Stagger Tooth Side Milling Cutters	Counterbores
Shell End Mills	Countersinks
Slot Cutters	Reamers
	Hollow Mills
	Taper Shank Drills

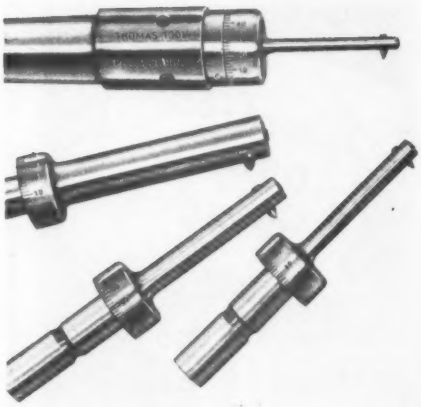
Straight Shank Drills

Prompt Delivery on Special Tools, Dies, Jigs And Fixtures Made To Your Exacting Requirements

Write for prices on standard sizes or submit blueprints for quotations on special sizes.

Galter Manufacturing Co.
711 W. Lake Street - Chicago, Ill.

Positive Locking Featured in Thomas Tools

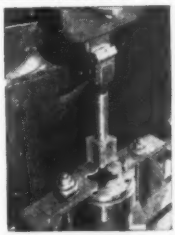


THE outstanding feature of the Thomas chasing and recessing bar is a quick, accurate control of the tool bit at a point at one end of the bar, which is always accessible to the operator. This control is such that the tool can be extended, retracted and locked at any point within the range of adjustment and accurately located radially from the center of the bar by means of the graduated collar.

In the pilot bar form, when the bar cannot be moved from the center of the spindle from side to side, the cutting tool can be moved accurately to cut recesses, grooves, undercuts and counterbores while the work is in motion, thus securing the advantages of the rigidity of a pilot bar over the conventional type supported only at the shank end.

This tool is especially suitable where long holes have to be chased. The procedure is to pilot the bar in the lathe spindle, supporting the shank of the bar in a support mounted on the compound or tool post rest. The chasing tool bit can then be adjusted, locked, a cut taken through the hole, retracted and the bar withdrawn for the next cut. The graduated collar provides an accurate means of setting the cutting tool.

Thomas Tool Co., P.O. Box 5069, Dept. TJ, Pittsburgh, Pa., will send descriptive literature.

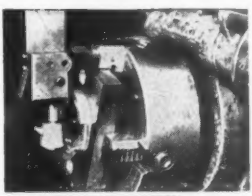


4 *of the many ways . . .*
SLOTMASTER *can be used to save* **TOOLS & SET-UPS**

Left: Set-up for lapping deep impression die.

Below: Set-up for cutting an internal gear.

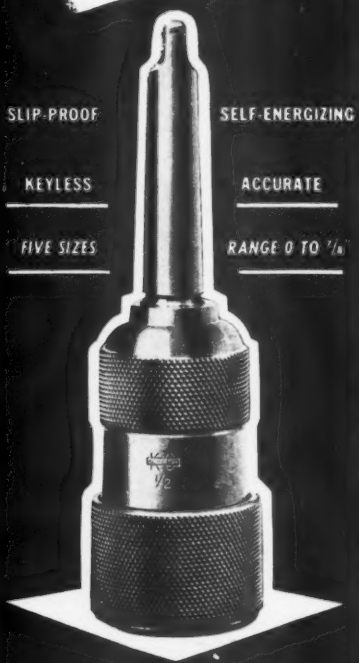
SLOTMASTER can be used on any round or flat-on-round over-arm milling machine and will do precision work that normally requires a multi-thousand dollar machine (all of the working parts are of tool steel, heat treated). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. The tool holder is of the clapper box type and can be turned in any position . . . SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc. . . . *Send for 4-page catalog—give specifications of the milling machines you wish to equip. Immediate deliveries on high priorities.*



EXPERIMENTAL TOOL & DIE COMPANY
12609 Greiner
Detroit, Mich.

Below: Conventional set-up on a round over-arm milling machine; thumbnail shows set-up for cutting a spline.

Knock-Out DRILL CHUCKS



Write for bulletin DC. 42-TD

KNOCK-OUT

K. O. LEE CO.

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EFFICIENCY for the PRODUCTION BATTLEFRONT

Speed Up Victory with "Oliver"

The tool behind the tool that does the job will help to speed up your production. 100% efficiency can be obtained only with tools that are well sharpened and kept in perfect condition. Speed up production by faster sawing and filing operations with Oliver Die Making Machines. They save 50% to 60% of the labor over hand methods in the cost of making precision Dies, Gages, Cams, Templates and similar products requiring rapid and accurate sawing, filing and lapping operations. It will pay you to investigate the line of Oliver Die Making Machines!

Send for descriptive literature today!

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1436 Maumee St., E. -:- Adrian, Mich.

New Gage Speeds Boring Work

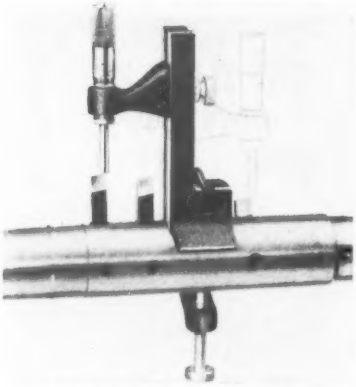
MODEL B Pedestal Micrometer, recently introduced by Bartelt Engineering Co., was primarily designed for setting closely-spaced boring tools quickly and accurately.

This gage consists of a pedestal having a base with a wide vee opening and flat surfaces at the ends of the extensions. With the vee groove it can be placed on a boring bar where it is held by a removable clamp which engages a slot in the top of the base. The flat surfaces enable the gage to be placed on a surface plate, a machine bed or any other plane surface from which measurements are to be made.

The upright portion of the pedestal is finished on both sides. An arm, which carries the micrometer head, is clamped to the vertical surface with a screw through a slot in the upright. Because the new pedestal is double-faced, this arm may be clamped to either side as desired and can be changed from one side to the other without changing the clamped position of the pedestal.

The pedestal base permits the gage to fit between boring tools having as little as 2" spacing between them. Taking the overhang of the arm into consideration, boring tools placed 3½" apart can be set without changing the pedestal by simply clamping the micrometer head first on one side and then on the other.

The flat portion of the base permits the micrometer to be used as a height gage, depth gage and for other machine setups.



Bartelt Engineering Co., 1212 Partridge Ave., Beloit, Wis., will send complete data.

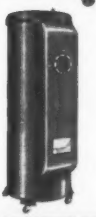
Revco

INDUSTRIAL REFRIGERATION

REVCO Engineers have pioneered and produced the finest both in custom and standard lines of refrigeration equipment for industrial use.

SUB ZERO CHESTS

Features of compactness, sturdiness and precision are built into this unit. Adaptable to a wide variety of uses. Temperature to -75° F.



RIVET DISPENSERS

Automatic,—selective for refrigerated aircraft rivets. Make possible mass production rivet handling. Write for full details.

REVCO, INC., Deerfield, Michigan

★ WITH a Rousselle Victory Vise, accurate set-ups are simple—and fast! This is due to many features such as complete, easy-to-read graduations around the entire dial on the broad swivel base—the two convenient locking screws that hold your swivel setting securely—the lock nut on the main screw—extra ruggedness in the broad base, center pin, jaws, ways and screw—all of which assure long-lived precision. The hardened steel screw nut is removable and although the bearing areas on ways and sliding jaw are over-size, a special take-up plate provides constant alignment regardless of wear. Jaw plates are tool steel, hardened and ground. Point-by-point superiority in every detail has made the Rousselle the choice of experts. Get full data in Bulletin TD-73. Write today.

PROMPT DELIVERY — PRIORITY CERTIFICATION MUST ACCOMPANY ORDER.
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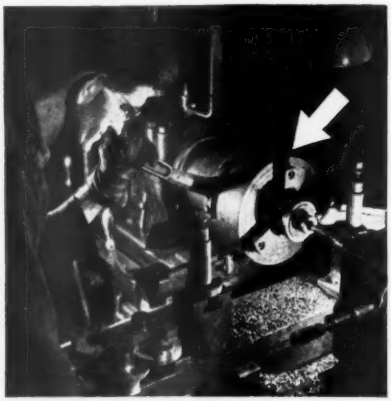
Rousselle Victory Vises are made in four sizes.

DAVID J. ROSS CO.
BENTON HARBOR MICH.



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increased a FULL THIRD

With BARKER WRENCHLESS CHUCKS AND VISES!

Pieces-per-hour went up from 18 to 24 when the Lovejoy Flexible Coupling Company replaced an ordinary three-jaw chuck on this P & J Automatic Lathe with a Barker Wrenchless Chuck—and stayed up—because the Barker Chuck is a simple, rugged, self-contained unit, requiring no accessories, auxiliaries or outside source of power. From the moment of installation, it delivers speedy, trouble-free service.

From a trifling investment you obtain continuous generous dividends in time saved, production increased.

Ask for Bulletin 4-A.

THOMAS HOIST CO.
Chuck Division
20 So. Hoyne Ave., Chicago, Ill.

(Continued from Page 199)

front end, the head carries an adjustable, bronze plain bearing for the spindle; at the other end, a pair of matched precision preloaded ball bearings.

This combination of bearings combines the rigid location of the spindle made possible by the preloaded, angular contact ball bearings with the vibration dampening property of the plain bearing at the front end. The spindle itself is made of carefully selected alloy steel, with the front bearing surface lapped to a superfine finish.

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permit forceful, effective blows without battering, scarring or marring. They protect fine finishes, delicate insulation, hardened parts and costly machinery. They far outlast other mallets, hold a true striking face and, because they absorb recoil, they are less fatiguing on continuous use operations (as pounding in winding, assembly work, etc.). Speed production—reduce spoilage. All sizes. Weighted or unweighted.

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"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS

We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort. We are also glad to announce our new Universal Mikrolok, the boring bar which can be quickly adjusted like a micrometer to limits of .0005 or less. Write for catalog.

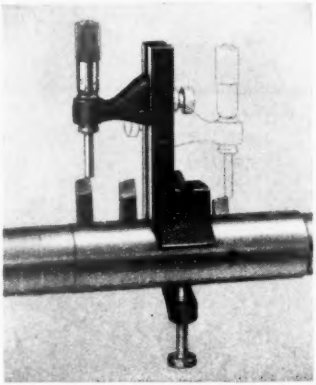
UNIVERSAL ENGINEERING CO.
FRANKENMUTH, MICHIGAN

For fast, accurate setting of close-spaced boring tools . . .

BARTELT MODEL "B" PEDESTAL MICROMETER

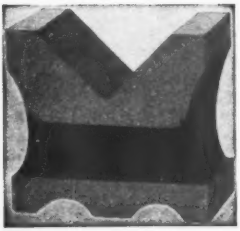
formerly called Bartelt Tool Setting Gage

★ By reducing the length of the base and by providing slides on both sides of the pedestal, the usefulness of the Bartelt Pedestal Micrometer has been greatly increased with this brand new Model "B". As the illustration shows, tools placed 3½" apart can be adjusted in one setting of the gage, by simply changing the micrometer support arm from one side of the pedestal to the other. Also, the shorter base permits attachment to a bar on which the space between tools is as little as 2". *This gage will speed up boring work because it greatly reduces the time necessary to get an accurate setting of the cutting tools.* As with other models, the base has both flat and vee surfaces so that the Pedestal Micrometer may also be used for a depth gage, a height gage, for inspection, for machine set-ups, and many other purposes. Three clamps are furnished with the gage, to fit all boring bars from 1" to 5" diameter. *Write for Circular.*



BARTELT
ENGINEERING COMPANY
1212 PARTRIDGE AVE.
BELOIT • WIS.

"TRU-V" BLOCKS



Why Not Save Time — by having enough V-Blocks available at all times in your shop to avoid the delays involved in make-shift set-ups and tie-ups?

"TRU-V" Cast-Iron Blocks are available in nine sizes—from 3½ to 10" in three styles. Each block is carefully machined on all sides, with close limits held within .001" where required. A machined ledge on both sides provides for clamping on machine bed.

Let us send descriptive bulletin.
Or contact your mill supply dealer.

Oliver Motorcraft Corp.
2536 S. Wabash Ave., Chicago, Ill.

Columbia TOOL STEEL

GRADE LABELING—

Customers of this company have always had the benefit of informative grade labels which clearly identify each product.

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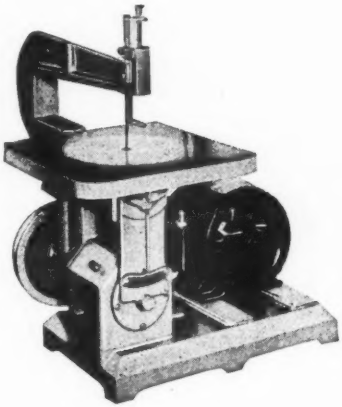

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Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The hold-down fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

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ATLAS EQUIPMENT COMPANY
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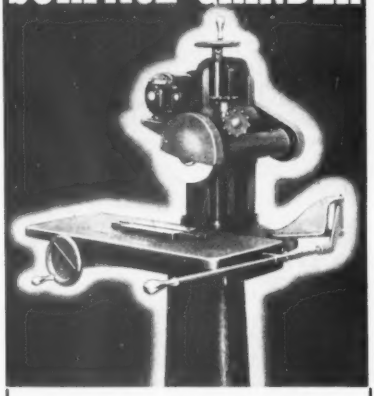
BUILDERS 'T' SURFACE GRINDER



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Here's the hand-operated grinder for countless small jobs . . . It pays to keep *several* available!

Prompt Deliveries

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BUILDERS IRON FOUNDRY
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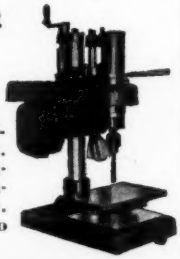
The HAMILTON MUEHLMATT Super Sensitive DRILLING MACHINE

DRILL SMALL HOLES QUICKER

and save wear and tear on small drills.



Better seeing . . better feeling . . better drilling with this self-contained drilling unit. Swings radially. Locks to any positions. Used singly or in multiples in production, maintenance or laboratory. For holes from .004" to $\frac{5}{16}$" diameter.

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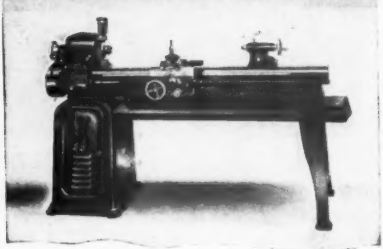
Ninth and Hanover Streets.
HAMILTON OHIO

SHELDON



SHELDON BBU-1240 WQ PRECISION LATHE

This quality 12" precision tool room lathe has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated Underneath Motor Drive enclosed in the pedestal leg is so designed that spindle belts operate thru a standard 1-piece bed. Beds are industrial weight heavily braced with hand scraped ways (2 V-ways and 2 flat ways). Write for catalog of SHELDON 10", 11" and 12" Precision Lathes.

SHELDON MACHINE CO., INC.
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M-B "UTILITY" Pneumatic GRINDER

MODEL U-TR
A 60,000 R.P.M. Unit

STEEL HOUSING—FOR SAFETY

VICTORY hinges on production speed. That's why the use of this fast cutting tool is so important.

Designed for real production work and the toughest jobs. A powerful, high speed grinder, widely used and recommended . . A worthy companion to our famous "SUPER SPEED" MODEL S.S.S.R. Precision made, streamlined, excellent balance. Special grease-sealed bearings—no lubrication required.

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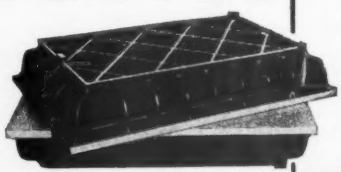

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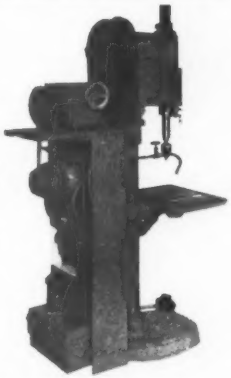

Four outstanding advantages of the new Model DB unit tapping machine are 16 speeds, dual control, 1¼" capacity and precision depth stop. In addition, this model incorporates all the features of the older Model D.

Equipment includes a 3 hp reversing motor for the spindle drive, a motor driven coolant pump and return tank.

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All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6° diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

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Send for Free Catalog and Grinders Instruction Card.

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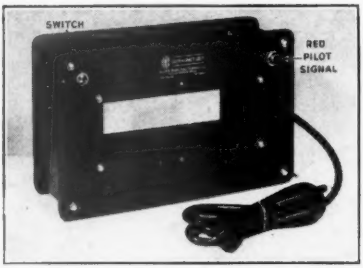
AMC DEMAGNETIZER

A Tool Room Necessity



Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.

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Write for full information.

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1619 Madison Ave., S. E., Grand Rapids, Mich.

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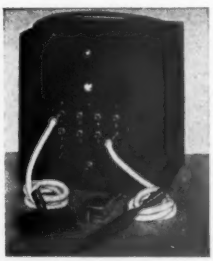

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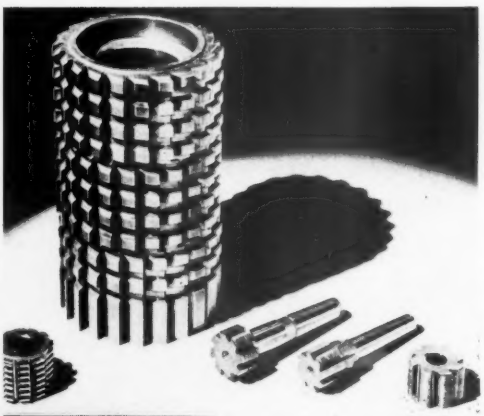
PROGRESS ON P

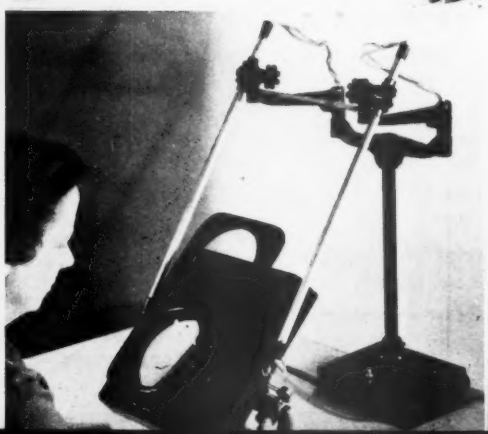
EXPERIENCE gained in the manufacture of Plan-O-Mill, a machine used in thread milling a wide variety of parts—from gun tubes to spark plugs—forms the background of a new venture of the Plan-O-Mill Corp. A new line of multiple thread milling cutters (shown below) in National Whitworth, Acme, V and special forms is being offered. They are available either ground or unground, for use on any type of thread milling machine. The cutters may be had with straight or spiral flutes, with or without special tooth for removal of imperfect thread. For further information write the company at 1513 E. Eight Mile Rd., Hazel Park, Mich.

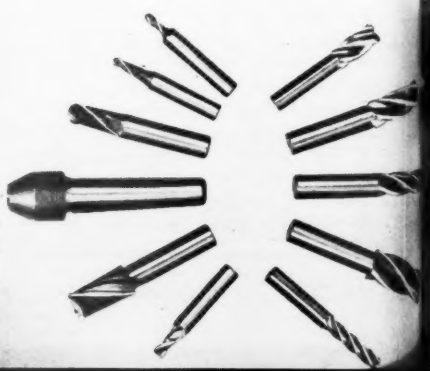


THE "Inspector" manufactured by the Larrimore Sales Co., P. O. Box 1234-J, St. Louis, Mo., combines two-tube fluorescent "daylighting" with single or double 5" magnifying lens to assure accuracy and eliminate eyestrain in inspection work. It will be found serviceable by tool designers or makers, in First-Aid, by the engineering department and others in reading small detail on maps, blueprints, micrometers, etc., and in maintenance for setting spark plug gaps, examining working edges of reamers, drills, etc., and in checking the accuracy of regrinding of twist drills, and hundreds of similar uses. (Shown left below.)

LARGE scale production is in progress on Fray Kut End Mills (below, right) according to an announcement made by Fray Tool & Reamer Co. These end mills come in eleven styles, each style designed for a specific purpose. They are made of high speed tool steel individually heat treated for the size and type of cutter and work for which they will be used.

A recent expansion move in which larger plant facilities were acquired by Fray Tool & Reamer Co., a subsidiary of Fray Machine Tool Co., Inc., permitted this increase. Further information will be supplied by the Fray Tool & Reamer Co., Dept. K, Glendale, Calif.



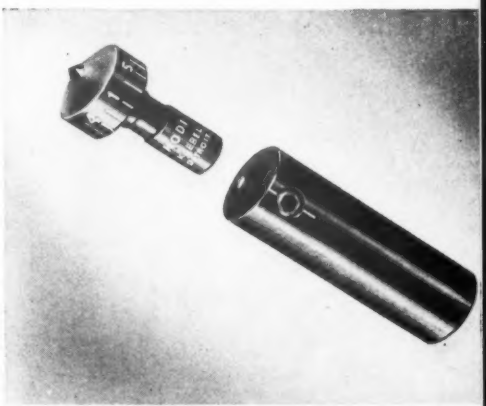


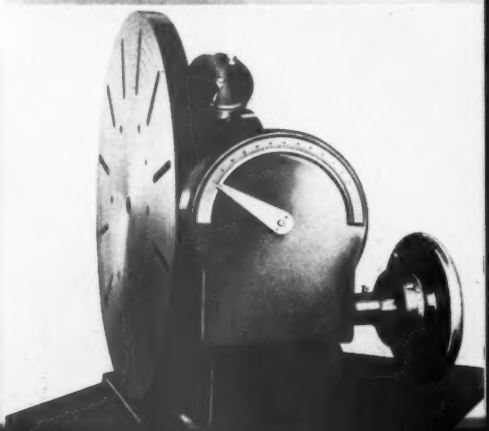
PARADE

A NEW diamond dressing tool that fits most standard grinding machines does away with the necessity of a special dresser for each machine. Known by the trade name of "Kodi", the tool is manufactured by the Koebel Diamond Tool Co., 9459 Grinell, Detroit, Mich. It is supplied initially with a special shank or Ko-Adaptor, fitted with a recessed head set screw which locks the standard Kodi nib in position. Once installed, the Ko-Adaptor remains on the machine. Only the Kodi nib is removed for resetting or replacement. Since one Kodi nib fits all Ko-Adaptors, the replacement supply need never be very large. (Shown top, right.)

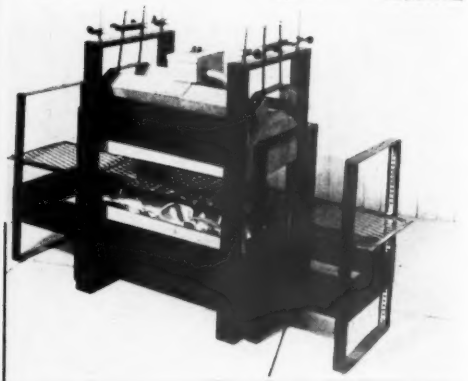
JOHNSON'S wet cutting model (below) is designed for faster, more efficient metal cutting. This coolant model means longer life for saw blades. The coolant feature has been provided for customers who are doing production work and require high speed cutting in excess of that provided by the regular dry cutting machine. Several important features guarantee the practicability and efficiency of the Johnson saw. Some of these are the non-clogging piston type pump driven by a noiseless cam; power is taken from already present drive gear; intake is screened to avoid dirt and chips from entering into pumping mechanism. Complete details furnished by the Johnson Mfg. Co., Dept. S, Albion, Mich.

THE new Rotab (shown bottom right) was developed by Machine Products, Dept. J, Detroit, Mich., for measuring large castings for radial motors. It has a 36" circular table on which the work to be measured may be clamped. Without disturbing the original clamping, an inspector can measure all the angles on the work. By means of geared turning wheels, the table can be rotated to any degree and to any angle from the vertical position to the horizontal and then 30° below in the opposite direction. Dials showing degree and minute graduations register the angle of setting. A 10" sine bar is provided for use in cases where greater accuracy is required. After the table is set it may be securely locked in a fixed position—radial or angular—during the task of checking measurements. It may also be disengaged to rotate freely by hand. The device also lends itself as a holding fixture for boring mill setups.

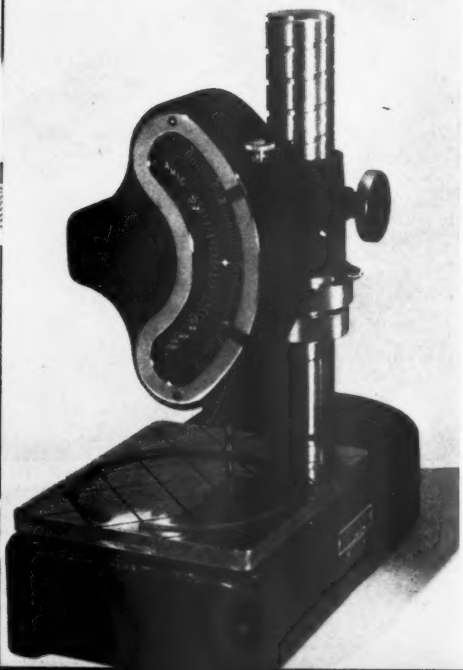




AN example of a specially designed Robbins & Myers die shop crane is shown left. Low ceilings in the plant where it was to be used required every inch of lift obtainable; internal compact trolley and butted end trucks enabled the customer to handle larger dies in the same shop freely and with accurate control. The crane has a 12-ton capacity, 12-foot lift, a hoist speed of 7 fpm, and 3-60-220 voltage. For complete details on this and other R & M cranes, request Bulletin 825 FS from Robbins & Myers, Inc., Springfield, O.



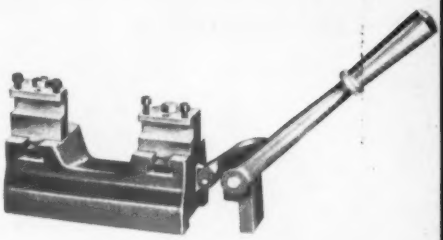
INFRA-RED equipment, in many different standard models from small 2 cu. ft. ovens to large drying ovens is offered by Infra-Red Engineers, Inc. One of these ovens is illustrated, left. They are used for shrink-fitting, drying metal parts after washing, green sand mold drying, baking of impregnated motor windings, preheating and drying plastics powder or sheets prior to molding, punch press operations or forming, paint, enamel and lacquer drying, acceleration of growth in gages and many other applications. Literature is available from Infra-Red Engineers, Inc., 809 Caxton Bldg., Cleveland, O.



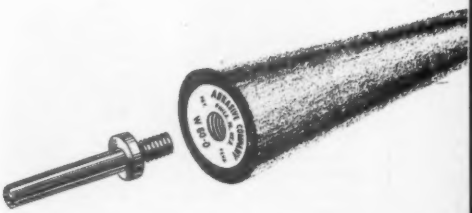
THE new addition to the AMIC line of comparators is mounted on an accurately machined cast iron base into which is built a parallel ground, lapped and serrated 6½"x8" table. It is adaptable for measuring the width of piston rings, particularly of aero-engine piston rings, and other components of large area. The column has double nut adjustment, one coarse and one fine, for accurate setting of the comparator by means of a master gage or Johannsen block. Two limit hands in the form of sliders serve to indicate the range of tolerance requirements. As in all AMIC Comparators, the magnification is 1:1000. A displacement of the measuring pin of .001" causes the indicating hand to move 1" on the 6" dial, which has inch and millimeter readings. Each inch is divided into tenths, each tenth indication .0001". Complete details may be had from the American Measuring Instruments Corp., 240 W. 40th St., New York, N. Y.

GRAYSON-KENNAMETAL cutters, constructed with sturdy bodies of Meehanite tipped with Kennametal are available through the international sales and engineering department of the McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa. The shock resistance of the body is combined with the hardness and strength of Kennametal to produce a rugged tool for rapid and accurate face milling, side milling, end milling, slot milling and straddle millings. The cutters will help in achieving maximum speed and production on milling operations. Write for further details.

A NEW lever-operated cross slide for doing both forming and cutoff work in a single operation has been added to the line of lathe tool attachments manufactured by Kessler Aero Tool Products Co., 211-J, W. Palm Ave., Burbank, Calif. Designed for easy adaptation to Atlas, Logan, 9" South Bend, Craftsman, and similar lathes, this double tool post device operates without disturbing tool or carriage positions, according to the maker. Conversion of engine lathe to production lathe, and vice versa, can be effected in a few moments as the cross slide fits the dovetail on the lathe carriage.



ABRASIVE CO., Tacony and Fraley Sts., Philadelphia 37, Pa., announces new mounted Victory points with demountable spindles that can be removed and used again and again on other points—with a resultant savings of critical steel for other war production requirements. Victory points consist of a threaded porcelain bushing inserted in and fused to the abrasive wheel mass at the high heats of kiln temperatures during the vitrification process.



TOGGLE Pliers No. 455 were designed by De-Sta-Co to hold piping, tubes, rods or other cylindrical parts during manufacturing operations. These pliers lock into position and hold securely at any point within their gripping range, and are easily and quickly released. For specific information, write Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.

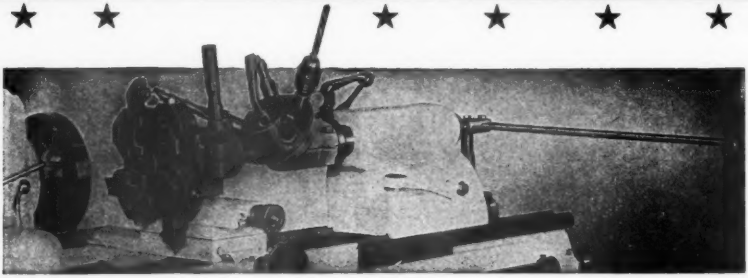
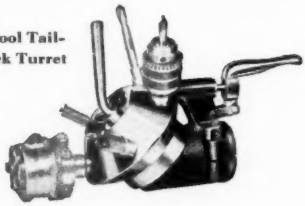


Photo above shows Jefferson Turrets on 16" lathe

Convert

YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

5-Tool Tail-Stock Turret



Yes, it's as easy as that! You simply attach the Jefferson Tail-Stock Turret, the Jefferson Tool-Post Turret, and the Jefferson Adjustable Pull Feed to your lathes as shown in illustration, above.

The productive capacity of these machines will be more than doubled in many instances because there will be available at all times NINE DIFFERENT TOOLS.

With these three JEFFERSON time-saving devices attached to a lathe, any kind of work may be done, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe, or changing tools. THE JEFFERSON TURRETS are made very substantial, rigid, accurate and in several sizes to fit small bench lathes up to 24" swing.

Pat. Pending

4-Tool Tool-Post Turret

We also Manufacture the Jefferson Bull Dog Precision Milling Machine. Obtainable Power or Hand Feed.

Jefferson Turrets are real production tools — substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

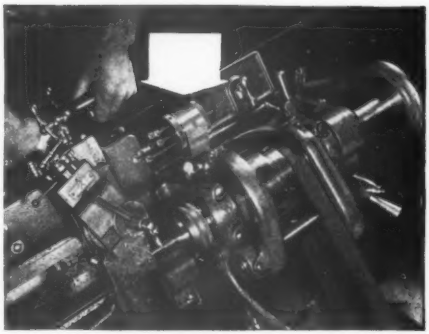
TURRET DELIVERIES IN 6 DAYS

Write for further details of these and other Jefferson time-saving machine tools and machinery.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

Multiple Lathe Stop Saves Setup Time



VARD offers a new precision-built lathe attachment with six accurate indexed stops for increased production and for setting up multiple operation jobs in quick time.

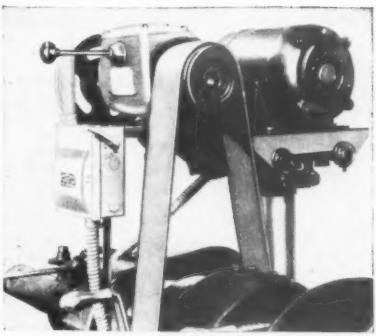
The lathe stop consists of three parts: the body (foundation of the unit), which rests on the front v-way of the lathe; the cylinder, housed into the body and containing the adjustable stop screws; and the clamp, which fastens the body to the lathe way.

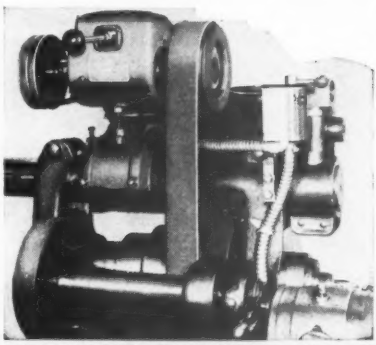
The body block is 1½" wide, cold rolled steel with a v-slot conforming to the contour of the standard v-way lathe. The body is bored to hold a precision ground cylinder of case hardened steel and bears steadily on the v-way.

A Vard lathe stop combined with any 4-way turret tool post makes any lathe a production machine. The attachment provides an accurate, positive lathe setup for multiple operations. Its rotating cylinder, indexed and engraved with sequential numerals at each stop position, is fitted with six long adjustable stop screws. These screws act against a boss screwed onto the traverse carriage of the lathe. By setting each lathe stop screw to the desired length of carriage travel, six cutting operations on one piece of work can be established on the first unit.

For further details write: Vard, Inc., 2981 E. Colorado Ave., Pasadena, Cal.

LATHES, MILLING MACHINES





shapers, turret lathes, radial drills, slotters, etc., are motorized with WESTERN MASTER (1-5 h.p.) Transmissions with bracket . . . . . $95 WESTERN MAJOR (5-10 h. p.) Transmissions with bracket . . . . . $145 and a WESTERN SUPER (up to 30 h. p.) for replacing gear boxes on large boring mills, radials, Gisholt milling machines, etc.

We can also supply necessary V-belts, sheaves, out-put pulleys and motors from stock. Prompt deliveries on high priorities.

up to 30 h. p. For Motorizing Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Slotters, Belt Cutters, Gear Cutters, Die Sinkers, Boring Mills, etc.

WESTERN TRANSMISSIONS

WESTERN MANUFACTURING CO. 1600 SCOTTEN - DETROIT, MICHIGAN

Photo-Exact Copies Possible With Apeco

THE most interesting feature of the Apeco Photocopy machine is its simplicity of operation. No skill is required to produce perfect photocopies of anything printed, written, typed, drawn or photographed. No supervision is needed—the new employee can begin work at once, releasing stenographers, typists and draftsmen and their equipment for other work. Size of copies obtainable—up to 18" x 22".

The machine has almost no working parts and presents practically no repair or maintenance problems. It is so small it can be set up on any desk or table in the plant or office. No darkroom is needed.

Because copies are photo-exact, no proofreading is necessary. It may be used to duplicate letters, contracts, agreements, inquiries, financial records and statistics, and to make copies directly from blueprints without first making tracings.

Written by specialists in the field, the popular book, "Die Designing and Estimating", may be had for $3.00, plus postage, from the American Industrial Publishers, 302 Fairmount-Cedar Bldg., Cleveland, O.

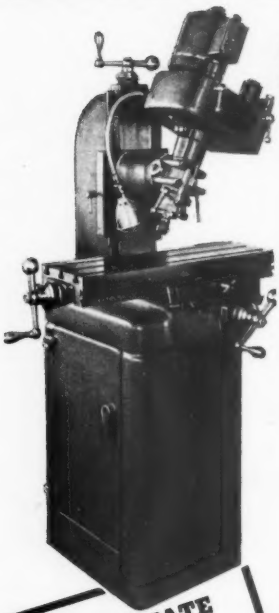
The device is remarkably rapid in operation, enabling a single employee to do the work of many. It is now in use by large and small industries, major airlines and war plants.

Additional information on the photocopy machine may be obtained from the manufacturer, American Photocopy Equipment Co., 2849 N. Clark St., Dept. 184, Chicago.

HOLLAND MILLER

With

SWIVEL HEAD



This rigid and versatile miller answers the need for a flexible toolroom and production machine with an unusually wide range of speeds. Note these exclusive features:

- Controls of table and head are all reached conveniently from the operator's seat.
- Rigid table mounting at permanent height provides extra stability and accuracy.
- Swivel Head, with motor centered above spindle, has 8" travel and 3" quill feed.
- A wide range of speeds, 200-4375 RPM, with standard motor, or ⅓ less with slow speed motor, is offered for boring and high-speed milling.

Write TODAY for complete specifications and descriptive details.

IMMEDIATE DELIVERY

J. W. HOLLAND CO.

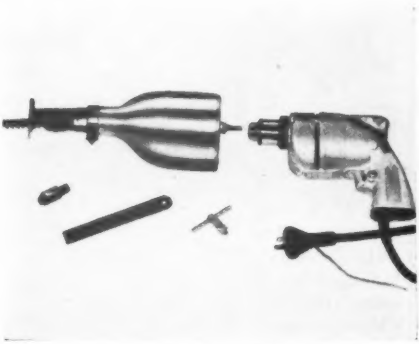
Box 107

Fitchburg ● Mass.

Saw-Gun Attachment For Electric Drill

THE new Mid-States saw-gun is described as an attachment for an electric drill, flexible shaft or compressed airline, creating an efficient portable power saw or file. This attachment, it is claimed, saves hours on panel notching, slotting or other fabricating operations on plastics, stainless steel, monel metal, corrugated or plain steels in heavy gages.

The saw-gun will cut directly into wood or plastic without a drilling hole for a starter. It can be used to great advantage by electricians, sheet metal workers, machinists and is ideal for "hard-to-get-at" places that are practically inaccessible with other tools.



Ready Soon

Current information on dependable products, manufacturers and dealers is being prepared in separate booklet form. The new 16-page directory is a reprint, with new names and products added, of the Buy With Confidence Section formerly appearing in The Tool & Die Journal. Copies available upon request.

According to the manufacturer, the saw-gun can be easily attached to a drill and is simple to operate. It is recommended for use on a drill with a speed of 2000 rpm or more.

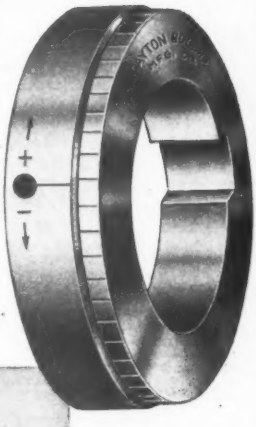
For complete details write to Mid-States Equipment Co., Saw-gun Div., Dept. TD, 2429 S. Michigan Ave., Chicago, Ill.

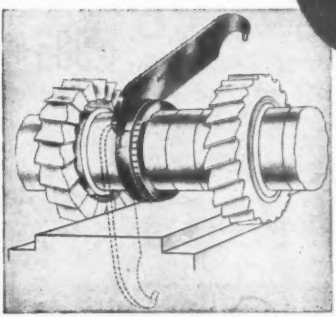
POSITIVE SPACING

Accurate to a split thousandth

Here's the biggest little time-saver yet for side milling cutters, gang and other multiple milling set-ups. Quick! — just loosen cutter arbor nut. Positive!—a plus or minus adjustment down to a quarter thousandth is easily obtained with

"Dayton Rogers"
ADJUSTABLE
SPACING COLLARS





Collars are graduated in thousandths. With handy spanner wrench furnished you can make adjustments by .00½", up to ⅛". Made in 11 standard sizes for cutter arbors from ⅝" to 3". Write for bulletin.

DAYTON ROGERS MANUFACTURING CO.
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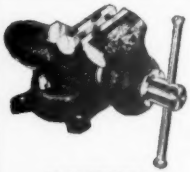

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GUARANTEE

SOMETHING REALLY NEW IN BENCH VISES

- INDESTRUCTIBLE
- INTERCHANGEABLE JAWS
- NO SIDE TWIST OR WOBBLING
- PRECISION GUIDED STEEL KEY (at base)

Sizes 3", 4" H.D., 4½" H. D. and 6" are built to conform to Federal Specifications GGG-V-436 as required by Army, Navy, etc.

Good Delivery on most sizes

SIZES AND PRICES

WIDTH OF JAWS	MAXIMUM OPENING	APPROX. WEIGHT	PRICE WITHOUT SWIVEL	PRICE WITH SWIVEL
2"	2"	10 lbs.		$10.40
3"	4½"	19 lbs.	$10.50	12.80
4"	5¼"	37 lbs.	16.40	18.60
4" Heavy Duty	7"	48 lbs.	17.90	21.00
4½"	5¼"	40 lbs.	19.10	21.30
4½" Heavy Duty	8½"	55 lbs.	23.00	27.50
5"	8½"	58 lbs.	28.00	33.60
6"	9½"	106 lbs.	48.50	62.00

Extra Jaws Available.....	2"	3"	4"	4½"	5"	6"
Smooth, Precision Ground Steel, Hard or Soft....	$1.65	1.90	2.85	3.30	4.40	5.50 pr.
Brass or Copper, Smooth.....	2.00	2.20	3.10	3.65	5.50	6.45 pr.

Send for Precision Production Tool Catalog No. 42

ACME TOOL COMPANY 196 CHURCH STREET NEW YORK, N. Y.

Speed - Smoothness - Accuracy
WITH THE
LEACH EXTERNAL GRINDER

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On small parts up to 7" in diameter, 11" in length.
Massive base and pedestal. Extra bearing area, 452 square inches of hand scraped bearing surfaces. Power feed—six table speeds—micrometer adjusted tail stock with spring action. Work spindle mounted on two precision roller bearings. Wheel head spindle mounted on three precision ball bearings. Hardened and ground tail stock and dead center spindles.

SPECIFICATIONS

Table Feeds—⅜", 1$\frac{1}{16}$", 1⅛", 1½", 2½", 3⅜" per minute.
Work Spindle Speeds—73-104-144-213-294 revolutions per minute.
Wheel Spindle Speed—2750 rpm. Spring Action Tail Stock.
Capacity ⅛" to 7" diameter, ¾" to 11" length.
Wheel—10" x ¾" x 2". Tank Capacity—3½ gallons.
Spindle Motor—¼ hp, AC, 60 Cycle, 110/220 Volt. Wheel Head Motor—1 hp, AC, 60 Cycle, 110/220 Volt. Regular equipment includes emery wheel, diamond wheel dresser, belts and wrenches.

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XACTOR

the pocket-size Protractor that measures all angles accurately.

NOW INDISPENSABLE TO THE CHIEF ENGINEER, RESEARCH ENGINEER, TOOL GRINDER, MACHINIST

XACTOR measures directly any surface angle, large or small, such as are ground on cutting tools, without the aid of attachments.

Quickly measures tapers on shallow blind holes or tooth angles on broaches, simply by sliding the Arm to suit your conditions.

Degree-graduations are arranged so the component angle is read directly, as well as required angle.

No clamps, no projecting set-screws, or other clamp-devices. Fits your vest pocket nicely. Ready for instant use.

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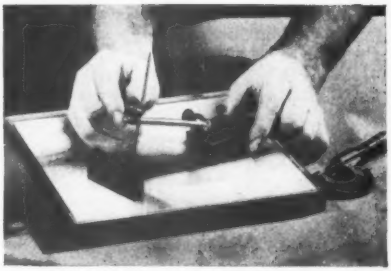
Industrial Engineering Co., Inc.
141 W. Jackson Blvd. Chicago, Ill.



NOW... THE NEW GLASS SURFACE PLATE

MADE OF SOLID PLATE GLASS

AFFORDS MANY ADVANTAGES

Cadillac Glass Surface Plates are now in wide use in Tool and Die Shops, and industries where accurate surfaces are required. Each plate is checked minutely and is absolutely within its specified accuracy, optical flats and monochromatic light being used. If details or data are desirable on under side of Plate, they can be etched thereon. Sketch showing requirement should accompany inquiry for prices.

COST of Cadillac Glass Surface Plates is low—probably less than resurfacing a scraped steel plate. Long life—Prompt delivery. Packed in individual wood boxes, top of which forms a protecting cover.

9 CADILLAC FEATURES

1—Accuracy .0002, .0003, .0004, .0005.
2—Checked carefully with optical instrument.
3—Hard surface. Wear shows as scratches. These do not affect accuracy unless grouped densely. Scratches do not burr.
4—Low co-efficient of expansion. Fahrenheit. 4.45 x 10^{-6}. Temperature changes have little effect.
5—Require no de-magnetizing.
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7—Transparent. Data or formulae may be placed under the flat for ready reference.
8—Easy to check. Optical instruments for checking purposes available in most large centers.
9—Replace critical material.

CADILLAC GLASS CO.
900 West Cermak Road
Chicago, Illinois

Help Increase Production
use the

SWEDISH INTERNAL INDICATOR GAGE

This light, easily handled instrument when used by machine operators, or on final inspection, serves to increase production, reduce scrap and assure a more uniform product. It is a reliable, precision indicator designed for rapid, convenient and accurate measurement of internal diameters. The scale range is: Plus or minus 0.001" graduated to 0.0001" and minus 0.020" graduated to 0.0001".

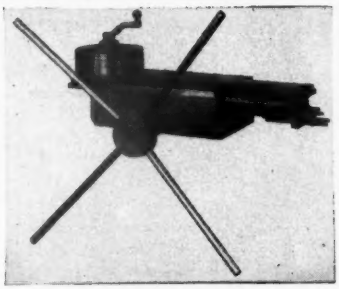
It can be set to any required size direct from Johansson Gage blocks or master ring.

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE., DETROIT 4, MICH.

New! **How to Convert Engine Lathes Into *Screw Machines!***

TURRET ATTACHMENT

Make your engine lathes do double duty by equipping them with Turret Attachments. Converts an engine lathe into a hand screw machine in 15 minutes—and vice versa—at a fraction of the cost of a new screw machine. Installed on the ways by simply removing tail-stock.



Fits Any Make Engine Lathe

A variety of models to fit any size and make of engine lathe. Six-station turret with automatic stops. Self-indexing to position. Adjustable screw stops. Write today for full information.

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Prompt Shipment!

● *Send for* ●
64-page Catalog of Standard Cutting Tools

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The COLLET CHUCK
FOR REAL PRODUCTION ON LATHES
UP TO 1½" SPINDLE SIZE
FULL SPINDLE HOLE CAPACITY
NO STOPPING DURING OPERATION • NO KEYS
ALSO USED FOR CHUCKING ON MILL AND DRILL PRESS
SEE YOUR DISTRIBUTOR OR WRITE FOR LITERATURE
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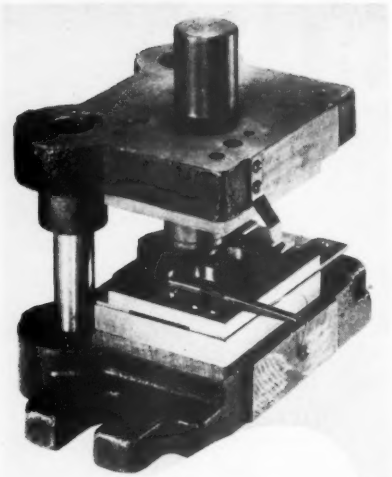
TOOL & ENGINEERING COMPANY
4031 WHITTIER BLVD. LOS ANGELES, CAL.



MODERN
AUTOMATIC STOP
for Progressive
and Compound Dies

● Speeds Die production; Eliminates spoilage due to carelessness and poor judgment; Lessens human fatigue; Requires no installation skill; Mounting Time approximately ½ hour; Hardened throughout.

Price 90c each

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MEAD
BURRING MACHINE

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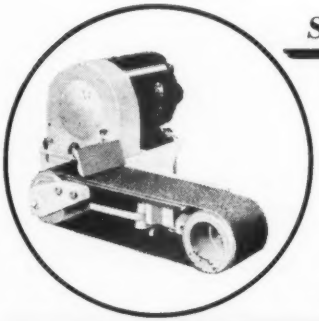

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This new, streamlined bench type grinder assures fast, quality finishing on metals, plastics, wood, fibre . . . at low cost. Built to machine tool specifications, Standard D-4 is equipped with improved band tension control and specially designed protective motor hood. 4x36¼" band. The ideal portable unit!

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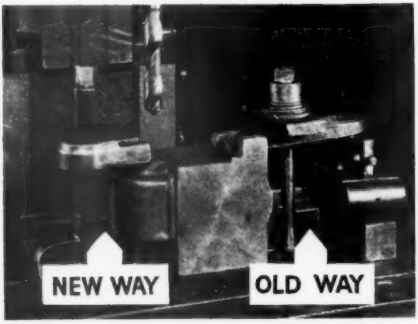

Coolant Pump Reprimes Self, Takes Hard Use

SIMPLY designed and easy to install, Model SP-400 Brady-Penrod centrifugal coolant pump nevertheless primes almost instantly on normal machine tool suction lifts. Sturdily built and including the features found in other Brady-Penrod models, it can withstand the 24-hour service, seven days a week, that present production schedules demand. It also reprimes when the sump pump runs dry, as soon as it is refilled.

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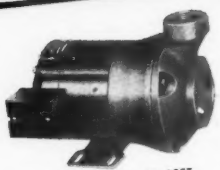
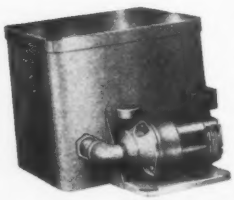
For a free bulletin giving details, write to Brady-Penrod, Inc., Dept. T-J, 1224 W. Second St., Muncie, Ind.

Penrod Centrifugal Coolant Pumps



MODEL P-10H



MODEL P-10H PUMPS ARE EASILY APPLIED PENROD PUMPS GIVE BETTER SERVICE

Model P-10H pumps use the motor feet for mounting and can be located in any position as long as the liquid will flow into the pump by gravity. This pump is easily installed on old or new machines and is ample enough to handle single or multiple installations. Model P-10H-⅛ will pump up to 1200 G. P. H. and Model P-10H-¼ up to 2400 G. P. H. Penrod pumps are conventional in style but we have incorporated many new features such as replaceable seal assemblies, totally enclosed motors, grease sealed ball bearings, streamlined design, etc.

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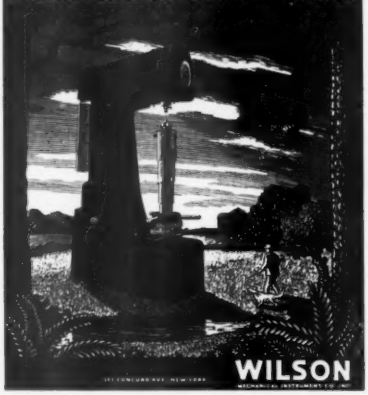

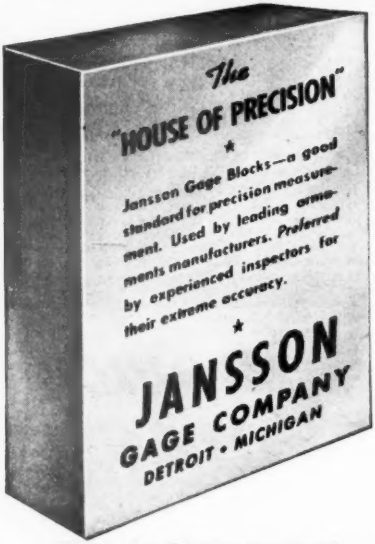
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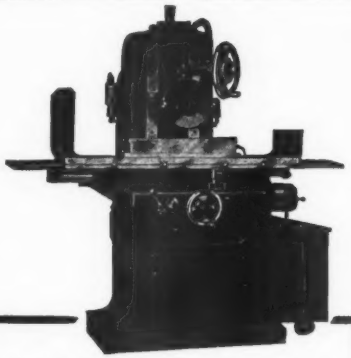

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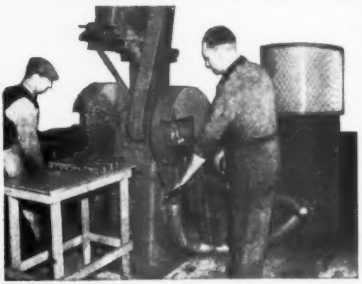

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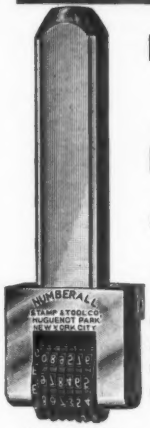

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STAMP NUMBERS, etc.
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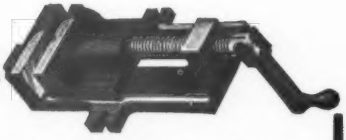

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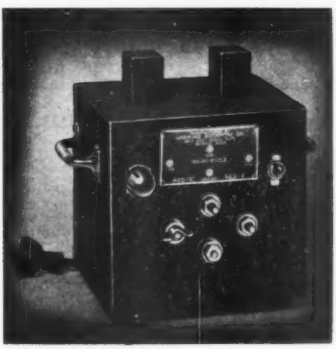

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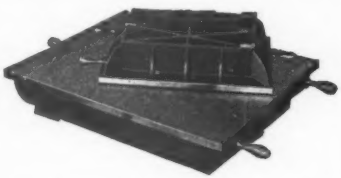

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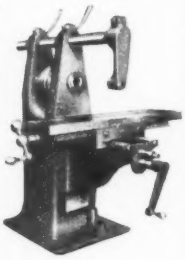

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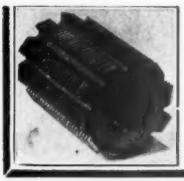

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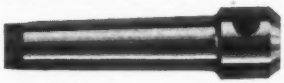

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EXTERNAL CYLINDRICAL LAPPING MACHINES
Special Machinery
TOOLS, DIES, JIGS, FIXTURES

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That's what put us in the tap business.

We offer our service to the industry on the basis of experience.

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Muskegon, Michigan

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A Complete Manufacturing Plant

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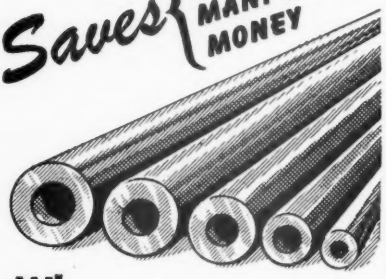
TOOL STEEL TUBING

Saves { TIME MANPOWER MONEY



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(Continued from Page 235)

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The World's Best Rubberized abrasives for Fine Grinding and Polishing

Attach this advertisement to your card or letterhead. We will send you a *free* trial sample. Or if you prefer send $1.00 for Special 33 wheel assortment.

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Sizes from 1/10 to 2 h. p. Pumping capacity up to 200 g.p.m. Many patented and exclusive features.

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Geared for Victory!

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DIX

PRECISION MADE AND AVIATION TYPE

UNIVERSAL JOINTS

15 STANDARD SIZES

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DIX MANUFACTURING COMPANY
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New Nesting Type Tote Pans

20" long x 12" wide x 6½" deep.
16 ga., drag holes and handles both ends.

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HIGH PRODUCTION

STAMPING - DRILLING - SPOT WELDING
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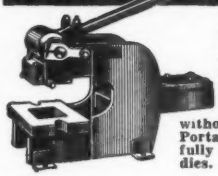

Max. cap. 2" dia. hole thru 10 ga. iron, proper shear on punch, throat depth 6". Takes punch press dies up to 3" x 4½" in area. Leaf arm gives perfect alignment without ways or leader pins. Portable. Used very successfully for "quick process" dies.

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Ask your dealer or write direct.

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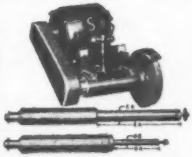

INTERNAL-EXTERNAL GRINDERS
½ to 10 H. P.
Write for Catalog 43

SPEED LATHES
¼ to 5 H. P.

The STANDARD ELECTRICAL TOOL Co.
Mt. Hope & 6th, Cincinnati, Ohio

How Better Design makes for Better TAPPING

Every item in the Procunier line of tapping equipment has been skillfully designed so as to produce definitely faster, more accurate tapping with less tap breakage!

Procunier Universal Tapping Machines offer: 1. Four speeds, ranging from 390 to 2050 RPM, efficiently handle jobs for which conventional high speed tapping machines are inadequate. 2. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads. 3. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR. In addition these machines are so designed that they actually allow the tap to establish its own lead.

Cross section of Tru-Grip Tap Holder showing positive drive to tap.

Procunier Tapping Heads Tap is driven by a double-cone, cork-faced friction clutch which automatically regulates tap driving power by pressure applied through the drill press spindle. Operators can quickly detect dull or loaded taps by the "feel" or pressure on the clutch. Many other special features.

Procunier Tru-Grip Tap Holders are the lightest on the market — one-third the weight of conventional tap holders. Tap has positive drive through the square hole broached in the collet. The tap is held in true alignment by the round of its shank, and tap shanks are never scored or disfigured. Other features include: Wide range of tap capacity; one piece body and shank; accepts standard size taps.

Send for Catalog

PROCUNIER
FOR FASTER MORE ACCURATE TAPPING

Procunier Safety Chuck Co. 12-14 S. Clinton St. Chicago, Illinois

Send me bulletin on: ☐ Universal Tapping Machines ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holder

Name .....

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ADVERTISERS INDEX

Abrasive Machine Tool Company 50
Acme Industrial Company 190
Acme Tool Company 220
Acromark Company, The 180
Advance Plating Company, The 27
Agerstrand Corporation 236
Aget-Detroit Manufacturing Company 230
Ajax Steel & Forge Company 182
Alco Tool Company, The 56
Allegheny-Ludlum Steel Corp. 23
Allison Tool & Engineering Co. 223
Alofs Manufacturing Company 210
American Cutter & Engineering Corp. 229
American Gauge Company, The 24
American Measuring Instrument Corp. 69
American MonoRail Company 157
Ames Company, B. C. 158
Anderson & Brown Co. 83
Armstrong-Blum Mfg. Company 244
Armstrong Bros. Tool Company 225
Arnold Tool Company 37
Atlas Equipment Company 207
Automotive Maintenance Machinery Co. 54
Auto-Ordnance Corporation 71

Baker Bros., Inc. 198
Barco Scraping Company 30
Bartelt Engineering Company 206
Barth Stamping & Machine Works 232, 235
Besly & Company, Charles H. 12
Bissett Steel Company 236
Black Drill Company 38
Blanchard Machine Company 52
Blank & Buxton Machinery Company 79
Boyar-Schultz Corporation 196
Brand Tool & Supply Company 228
Brewster-Squires Company 210
Builders Iron Foundry 207
Bunell Machine & Tool Company 29
Burke Machine & Tool Company 232
Busch Company, J. C. 231
Buss Machine Works 166

Cadillac Glass Company 221
Carborundum Company, The 149
Chicago Manufacturing & Distributing Company 14
Chicago Rawhide Mfg. Company 205
Chicago Wheel & Mfg. Company 73
Cincinnati Grinders, Incorporated 75
Cincinnati Milling Machine Co., The 74
Cincinnati Shaper Co. 45
Clark Co., Robert H. 176
Cleveland Pneumatic Tool Co., The 44
Cleveland Tapping Machine Co. 209
Cleveland Tool Engineering Co. 67
Cleveland Twist Drill Company 81
Cleveland Universal Jig Company 225
Colonial Broach Company 43
Colonial Bushings, Inc. 228
Columbia Tool Steel Company 206
Conrad & Moser 235
Cratex Mfg. Co. 237
Crobalt, Inc. 195
Cullen-Friestedt Company 197

Cullman Wheel Company 172
Cunningham Co., M. E. 209

Danly Machine Specialties, Inc. 18
Darwin & Milner, Inc. 186
Davis Tool & Engineering Company 234
Dayton-Rogers Mfg. Co. 98, 219
Dearborn Gage Company 57
Delta Manufacturing Company 81
Denning Manufacturing Company 235
Detroit Reamer & Tool Co. 68
Detroit Stamping Company 181
DeVlieg Company 76
Diamond Tool Company 39
Diamond Tool Company (Not Inc.) 210
Di-Machine Corporation 174
Die Supply Company 199
Dix Manufacturing Co. 237
Douglas Machinery Company 161
Dreis & Krump Mfg. Company 234
Dresel-Betz Company 234
Drive-All Mfg. Co. 17
Dumore Company, The 28
Duro Metal Products Company 187
Dykem Company 224

Eastern Etching & Mfg. Company 141
Economy Engineering Company 163
Electrix Corporation 148
Enterprise Machine Parts Corp. 9, 234
Evans Reamer & Machine Company 210
Ex-Cell-O Corporation 53
Experimental Tool & Die Company 201

Federal Tool Corporation 200, 234
Firth-Sterling Steel Company 48
Flex-Abrasive Co., The 194
Foley Manufacturing Company 188
Forging and Casting Corporation, The 2
Frantz Co., Inc., S. G. 185

Gallmeyer & Livingston Company 229
Galter Manufacturing Company 200
General Die-Stamping-Tool Co. Precision Collet Div. 51
General Die & Tool Company 235
General Tool & Die Corporation 151
Gibson Co., William D. 191
Gilron Products Company 171
Gorton Machine Company, George 155
Great Lakes Broach & Gage Co. 55
Grinding Machinery Tool & Supply Co. 231
Grobet File Company of America 198, 227

Hamilton Tool Company 208, 225, 236
Hammond Machinery Builders, Inc. 183
Hardinge Brothers, Inc. 3
Hartford Special Machinery Co., The 230, 234
Hill-Clarke Machinery Company 184
Holland Co., J. W. 218
Holo-Krome Screw Corporation, The 5
Honan Crane Corporation 160
Hotel Lafayette 225
Hovis Screwlock Company 80
Howell Clamp Co. 226
Hy-Pro Tool Co., Inc. 194

Here's how

SKILSAW TOOLS BOOST PRODUCTION at LINDBERG ENGINEERING CO.

SKILSAW PORTABLE GRINDERS—Speed up all grinding, wire brushing, buffing and polishing on metal surfaces ...remove rust, scale, paint, etc.

SKILSAW DISC SANDERS—For faster sanding on flat or curved surfaces of wood, metals, compositions. For grinding down raised welds, surfacing, preparing for finishes, buffing and polishing.

ARMY NAVY

Ask over at Lindberg Engineering Company . . . and you'll hear plenty about the speed of SKILSAW TOOLS in turning out essential heat-treating equipment. Look around the Lindberg plants that fly the Army-Navy "E" . . . and you'll see plenty of SKILSAW TOOLS in action . . . speeding up countless drilling, sawing and surfacing operations!

Here's the reason! SKILSAW TOOLS are lighter, more compact, more powerful. They're *preferred* by workers and management alike because they *handle easier* . . . do more jobs *better* . . . and stand up *longer* under today's toughest conditions. Ask your distributor to prove it with a demonstration of SKILSAW TOOLS on your work *today!*

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Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
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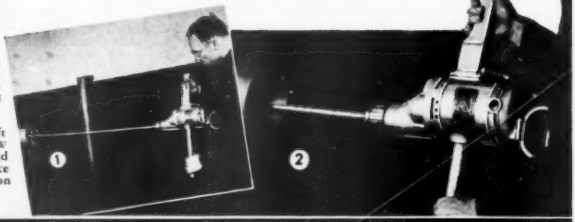

1. With a special rig devised by Lindberg engineers, SKILSAW Model 123 DRILL hones the interior of this air-tight steel cylinder; replaces complicated hard-to-get machinery.

2. Honing rig on long shaft (smoothly driven by SKILSAW DRILL) is moved forward and back by operator, to produce the polished high precision surface necessary.

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Illinois Tool Works ... 196
Industrial Diamond Co. ... 78
Industrial Engineering Co. ... 221
Industrial Machine Co. ... 235
Industrial Products Suppliers ... 233

J & R Specialties ... 233
Jansson Gage Company ... 228
Jefferson Machine Tool Company ... 216

Kearney & Trecker Corp. ... 173
Kent Aircraft and Gauge Co. ... 209
Kiffer Tool & Die Company ... 235
Krauth & Benninghofen ... 237

Lakeside Steel Improvement Co., The ... 154
Latrobe Electric Steel Company ... 72
Lauer Tool & Gauge Co. ... 227
Lavallee & Ide, Inc. ... 20
Leach Machinery Company, H. ... 220
LeBlond Machine Tool Co., R. K. ... 22
Lee Company, K. O. ... 202
Lempco Products, Inc. ... 16
Leslie Welding Company ... 237
Lewis Machine Tool Co. ... 232
Lima Electric Motor Company, The ... 60
Linderme Machine and Tool Company ... 156
Linley Brothers Company ... 193
Lorain Machine & Tool Company ... 235
Lucas & Son, Inc., J. L. ... 64, 237
Lufkin Rule Company, The ... 227

M-B Products ... 208
Majestic Tool & Mfg. Co. ... 190, 234
Manufacturers Supply Company ... 188
Masonite Corporation ... 41
Master Machine & Tool Co. ... 168
Matthews Co., Jas. H. ... 152
McGrath St. Paul Co. ... 227
McKinney Tool & Manufacturing Co. ... 42, 235
Mead Specialties, Inc. ... 224, 230
Melin Mills ... 13
Meyers Co., Inc., W. F. ... 178
Michigan Chrome and Chemical Co. ... 209
Modern Metal Specialties Co. ... 224
Moore Special Tool Co., Inc. ... 61
Motor Tool Manufacturing Co. ... 175
Muehlhausen Spring Corp. ... 36

National Acme Co., The ... 8
Neerup Industrial Equipment Co. ... 233
New England Carbide Tool Co. ... 35
Noble & Stanton, Inc. ... 235
Nobur Manufacturing Co. ... 143
Norton Company ... 26
Numberall Stamp & Tool Co. ... 231

Ohio Tool Company ... 6, 7, 235
Oliver Instrument Company ... 202
Oliver Motorcraft Corp. ... 206
O'Neil-Irwin Mfg. Company ... 34

Paramount Tool Co. ... 235
Peerless Machine Company ... 47
Penrod & Sons Tool & Engineering Co., Floyd ... 226
Perfex Dresser Company ... 40
Phoenix Machine Co. ... 235
Pipe Machinery Co., The ... 15
Procunier Safety Chuck Company ... 238
Production Machine Co. ... 230
Producto Machine Company, The ... 32
Putnam Tool Company ... 1

Quality Tool & Die Company ... 167

Racine Tool & Machine Company ... 31
Rane Tool Company, Inc. ... 235
Revco, Inc. ... 203
Robbins Engineering Company ... 234
Roberts Rubber Co., Weldon ... 189
Rockford Die & Tool Works, Inc. ... 234
Ross Co., David J ... 204
Royal Oak Tool & Machine Co. ... 234
Rusnok Tool Works ... 233
Ruthman Machinery Co. ... 237

Savage Tool Co. ... 10, 11
Sav-Way Industries ... 77
Schauer Machine Co. ... 184
Scherr Co., Inc., George ... 169
Schraner & Company, A. P. ... 235
Sheldon Machine Company, Inc. ... 208
Shore Instrument & Mfg. Co., Inc., The ... 233
Skilsaw, Inc. ... 240
Smillie & Co., C. M. ... 19
Smit & Sons, Inc., J. K. ... 170
Smith Tool & Engineering Co. ... 182
Sommer & Adams Co., The ... 236, 243
Sossner Co. ... 176, 177
South Bend Lathe Works ... 59
Standard Electrical Tool Co. ... 237
Standard Pressed Steel Company ... 178
Star Machine & Tool Co. ... 236
State Mfg. and Construction Co. ... 70
Stuart Oil Co., D. A. ... 229
Sunnen Products Co. ... 49
Swedish Gage Co. of America ... 222

Tamms Silica Company ... 233
Tannewitz Works, The ... 159
Taylor Machine Co., The ... 237
Thomas Hoist Co. ... 204
Thompson Grinder Co. ... 33
Timken Roller Bearing Co. ... 21
Tomkins-Johnson Company ... 58
Tool Engineering Service Co., Inc. ... 208
Tools & Gages, Inc. ... 82, 236
Toolthrift Company ... 233
Triplex Machine Tool Co. ... 144
Turchan Follower Machine Co. ... 62
Turner Gauge Grinding Company ... 153
Turner Uni-Drive Co., The ... 65

United Industries ... 222
United Precision Products Company ... 162
U. S. Machine Tool Mfg. Corp. ... 232
United States Treasury ... 229
Universal Engineering Company ... 186, 192, 205

Variety Machine & Stamping Co. ... 236
Viking Tool & Machine Corp. ... 235
Vonnegut Moulder Corporation ... 180

Wall Sales Corporation ... 225
Waltham Gauge Company ... 150
Webber Gage Co. ... 145
Welch Industries, Inc. ... 25
Welding Equipment & Supply Co. ... 46
Western Manufacturing Company ... 217
Wheelock, Lovejoy & Company, Inc. ... 192
Whistler & Sons, Inc., S. B. ... 165
Wilson, K. R. ... 63
Wilson Mechanical Instrument Co., Inc. ... 228
Witsek Manufacturing Co. ... 66

Yost Manufacturing Co. ... 231

Zagar Tool, Inc. ... 164

NEWS CHIPS

DON E. ROOT

"STRIKING" . . . "One of the most effective we've seen" . . . "Splendid treatment" . . . comments like these from readers keep coming in about our June flag cover. Everybody was enthusiastic, and in true, characteristic modesty, we must admit we liked it, too.

We're still waiting for the telegram, though. The award telegram, we mean, giving us first prize in the annual magazine cover contest. Surely the judges were duly impressed . . . maybe they just lost our address, or missed connections with Western Union.

At any rate, it's a grand old flag, all right, and we love to see it flying high. To borrow a phrase or two,

"It's the emblem of the land we love,
The home of the free and the brave,"

and nobody was happier to give it full display than Ernie Putnam and the rest of the Putnam Tool Co.—the space contributor.

The cover was designed by W. A. Lundborg, well-known Detroit commercial artist and member of the art department of Charles M. Gray & Associates advertising agency. Our sincere congratulations and deep thanks go to "Lundy", Charlie Gray, Mr. Putnam, the engraver and our printer for the kind of cooperation that makes for real pride in a job well done.

* * *

We liked the report on the pseudo-great man that we ran across the other day. He has three planes of progress. First, he quits shining his own shoes; then he quits writing his own letters; and finally, he quits writing his own speeches.

* * *

"We are strong because we learned to be strong before this war started," declares E. L. Shaner, Editor-in-Chief of *Steel*, in his analysis of the news. Commenting on the reports from Washington regarding the successful rate of production for war, he lays credit for industry's achievement to its heritage of free enterprise. "The man in the street is convinced that industry has done and is doing its job well. However, he doesn't know the whole story. He doesn't know exactly why industry is doing its job well. He may even think industry is doing it because the government "forced" it to do it. Or he may think that the present complex organization at Washington deserves credit for the job.

"The cold fact is that industry has been able to do a good job because it got a good start using the ingenuity, resourcefulness, ability and know-how which it acquired or developed under the system of individual enterprise. None of these assets came out of regimentation. All came from the period when each company was encouraged to be independent and self-reliant."

* * *

Cooperate! Remember the banana. Every time it leaves the bunch it gets skinned.

* * *

We've discovered a new process for using machine wastes—chips and cuttings—for the casting of small parts. The method will probably require several months for developments, but we've a promise that the full story will be told in The Tool & Die Journal when it's ready.

* * *

There are few shops in the country that don't have one or more of our now no-doubt famous series of Training For Victory reprints. Everybody finds 'em useful, *even other magazines.* We've covered tapping, drilling, welding, planer and shaper, threading, contour machining, broaching, grinding, milling, and turning techniques. The supply of the last three pamphlets is exhausted, but if you hurry, you can still obtain the others. More details in the ad on page 211.

VERSATILITY . . .

THE CLEVELAND NO. 1 VERTICAL MILLING MACHINE PERFORMS MANY DIFFERENT JOBS WELL.

SMITHSONIANS

J. Smith . . . . LF
J. T. Smith . . . 1B
John Smith . . RF
Jack Smith . . 2B
T. Smith . . . . CF
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Thos. Smith . SS
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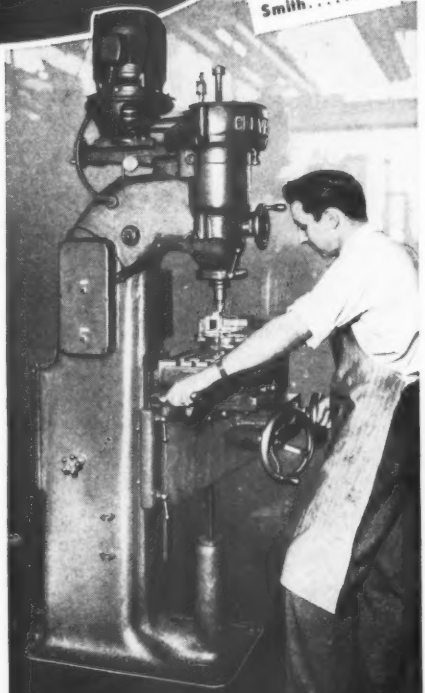


"You asked for it." Industry wanted and got in the Cleveland No. 1 a milling machine broad in its application — adapted to the fine requirements of *tool-making*, to varied types of exacting *die work*, and to the demands of *production plants* where long runs create severe operating conditions. Study the following features from the viewpoint of versatility:

1. Hand wheel and lead screw on spindle head for quick shifting of belts for changes of spindle speeds.
2. Also 3 speed changes on back gears, giving 12 speeds in all.
3. Feed box driven by ⅓ h.p. motor through V-belt with 3 speed changes on pulleys and 4 in gear box; 12 feeds in all to table.
4. Big, husky, spindle of chrome nickel steel heat-treated and mounted on 200-lb. pre-loaded precision bearings.
5. All lead screws and feed gears mounted on Timken bearings.
6. Longitudinal feed, 18"; cross travel, 8½"; vertical travel, 16". Spindle speeds — 100 r.p.m. to 1800 r.p.m.

Ask for Bulletin "D-7"

Good deliveries for proper priorities

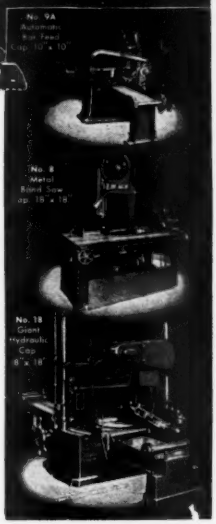
S&A

THE SOMMER & ADAMS COMPANY

18511 EUCLID AVENUE • CLEVELAND, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES

MARVEL SAWS



Research Laboratories need Versatile Saws

The New Kensington, Pa., research laboratory of the Aluminum Company of America uses the two MARVEL No. 8 Metal-cutting Band Saws pictured here, to cut test specimens from alloy steels and aluminum alloy products of every shape and description, varying from $\frac{1}{16}$" to 18" thick. The MARVEL No. 8 in the foreground has been in continuous service for 11 years and proved so "well suited for the large variety of sizes and shapes to be sawed," that the modern MARVEL No. 8 behind it was added.

Buy from your local distributor.